FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

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Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

1932

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Jan. 30. Cinque Ports Flying Club Annual Dinner and Dance, Rl. Pavilion Hotel, Folkestone.
Feb. 1. Essex Ae.C. Carnival Dance, Palais de Danse, Ilford.
Feb. 6. Rugby: R.A.F. *v.* Bedford, at Bedford.
Feb. 10. "Some Aspects of Meteorology in Connection with Gliding and Soaring Flight," Lecture by Capt. F. Entwistle, at City and Guilds Eng. College, S. Kensington.
Feb. 11. Herts and Essex Aero Club Annual Dinner and Dance, Holborn Restaurant.
Feb. 13. Rugby: R.N. *v.* R.A.F., at Twickenham.
Feb. 20. Rugby: R.A.F. *v.* Coventry, at Coventry.
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Feb. 24. "A Flight to Abyssinia," Lecture by Sqdn.-Ldr. J. L. Vachell, before R.U.S.I.
Feb. 24. Rugby: R.A.F. v. United Bank, at Ealing.
Feb. 29. "Flying Boats on Commercial Air Routes," Lecture by C. H. Jackson, at City and Guilds Eng. College, S. Kensington.
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Mar. 9. Rugby: R.A.F. *v.* Oxford University, at Oxford.
Mar. 10. "Results with the New Wind Tunnel at N.P.L.," Lecture by E. F. Relf, before R.Ae.S.
Mar. 16. "Development of Naval Air Work," Lecture by Commodore N. F. Laurence, before R.U.S.I.
Mar. 23. "High-Speed Flying," Lecture by Sqdn.-Ldr. A. H. Orlebar, before R.U.S.I.
Mar. 26. Rugby: Army *v.* R.A.F., at Twickenham.
Apr. 1. Entries close at ordinary fees for King's Cup Race.
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July 14. International Rally, Saint-Brieuc.
July 16-17. International Meeting, Dieppe.

EDITORIAL COMMENT

AN experienced administrator from India once gave it as his opinion that the Indian peasant was normally a truthful person, but usually became a perjurer when inside a law court. Can something similar be said about the nations of Europe who belong to the League of Nations? Do they normally tell the truth, but qualify for the famous Churchillian phrase of terminological inexactitudinarians when making official returns to the League?

Paper Aeroplanes

Our contemporary in Berlin, *Die Luftwacht*, has been probing the frailties of national human nature, and seems to have come to the conclusion that the questions asked above must be answered in the affirmative. At least this conclusion applies to France, and the group of smaller nations usually associated with her in foreign policy—Czecho-Slovakia, Yugoslavia, Poland and Rumania. All these countries have made returns of aircraft to the League of Nations which our contemporary believes to be far in excess of the actual numbers which they possess. A strange proceeding this. The ordinary simple-minded man would naturally suppose that if a nation wanted to tell a lie to the League, it would make a return of fewer aircraft than it possessed, and acquire merit for the steps which it had taken in the direction of limitation of armaments. To claim an excess of aircraft is to incur a degree of odium in Geneva circles, and not many nations would, one supposes, care to incur that. The alleged excessive returns by this group of nations must argue some deep Machiavelian design, and *Die Luftwacht* believes that it has been able to see through it. If France and her associates felt themselves compelled to agree to some reduction of their air strength, they would be able to surrender a number of their paper

aeroplanes, and still to maintain their actual strength, or possibly even to increase it.

This explanation is so very ingenious that its very astuteness arouses suspicion of its probability. France's attitude at Geneva has in the main been the simple and straightforward one of "We will not." Her feeling on the subject of reduction of air armaments is fairly expressed by an article in the January 21 issue of *Les Ailes,* which is headed "Pas un avion! Pas un pilote!" There is nothing Machiavelian about that. It is merely uncompromising. Moreover, *Die Luftwacht* is not quite logical in its line of argument about France and her declaration. In April, 1931, France sent in a return to the League of Nations showing a grand total of 3,000 aircraft, which *Die Luftwacht* believes to be an excessive figure. It then proceeds to argue that if that figure is to be accepted, it believes that France could actually mobilise 4,000 aircraft at once. This would mean, not an overstatement, but an understatement, and a policy diametrically opposed to that previously suggested. *Die Luftwacht* cannot have it both ways.

We have taken some pains to check the figures given by *Die Luftwacht* (which are published on another page) by examining those which it has given for Great Britain. We are flattered to read that our contemporary considers that the returns submitted by Great Britain to the League of Nations may be accepted as approximately correct. From the private sources of information on which it relies it has found a few minor discrepancies, which do not amount to enough to suggest a deliberate intention to mislead the League of Nations. Still, these alleged discrepancies are interesting, as they afford us some means of checking the accuracy of the private information on which *Die Luftwacht* relies. It is only fair to add that it admits some of its figures to be estimated.

In April, 1931, we made a return of 706 first-line aircraft in Great Britain, in Iraq, in the Middle East, in the Far East, and in the Fleet Air Arm. India makes a separate return to the League of Nations. Our total was made up as follows: "Military" (*i.e.*, R.A.F. aircraft other than the Fleet Air Arm), at home, 400; "naval" (*i.e.*, Fleet Air Arm), 153, and "overseas," 153. This figure was quite accurate in tallying with our establishments, even though one or two units had not at that time been fully equipped up to their establishment strength. From its private sources of information *Die Luftwacht* believes that our actual first-line strength was 1,090. It goes into details. For instance, we had, and still have, 13 squadrons of fighters with an establishment of 12 machines per squadron, which gives our declared total of 156 fighter aeroplanes. *Die Luftwacht* believes that we actually possessed 180 first-line fighters. That gives a difference of 24 machines, the equipment of two squadrons. Those two squadrons do not (unfortunately) exist, and never have existed, outside the imagination of the informants of *Die Luftwacht*. There cannot be the least reason for imagining that they existed, except the supposition that when reporting to the League of Nations even Great Britain cannot resist the temptation to be moderately untruthful. So it is with all our other detailed returns, day bombers, night bombers, reconnaissance aeroplanes, ship-planes, and flying boats, *Die Luftwacht* believes that all our returns are slightly incorrect, until the error in first-line machines alone amounts to 384 aeroplanes. Apart from our personal knowledge of the Air Ministry and our acquaintance with a number of officials there, of whose honesty we are quite assured, we have also a fair first-hand knowledge of the units of the Royal Air Force, and we can assure our Berlin contemporary that in the matter of fighters, for example, Great Britain does not possess, and has not possessed, more than 13 squadrons, with an establishment of 12 machines per squadron; and the same may be said of the other detailed returns. We may also take one other minor point of inaccuracy in the information which *Die Luftwacht* has received. It mentions the formation of a new flying boat squadron last year, but says that it is for training purposes. No. 210 (Flying-Boat) Squadron was formed last year and is stationed at Pembroke Dock. No definite type of boat has yet been allotted to it, but for the present it is using three "Southamptons," which have been brought back from Basra when No. 203 (F.B.) Squadron there was re-equipped with "Rangoons." No. 210 is not, however, intended to be a training squadron, but a normal coast-defence unit. This is a small point, but shows that the private information of *Die Luftwacht* is not infallible. So far as Great Britain is concerned, the paper aeroplanes exist only in the imagination of those who have supplied our contemporary with some of its information.

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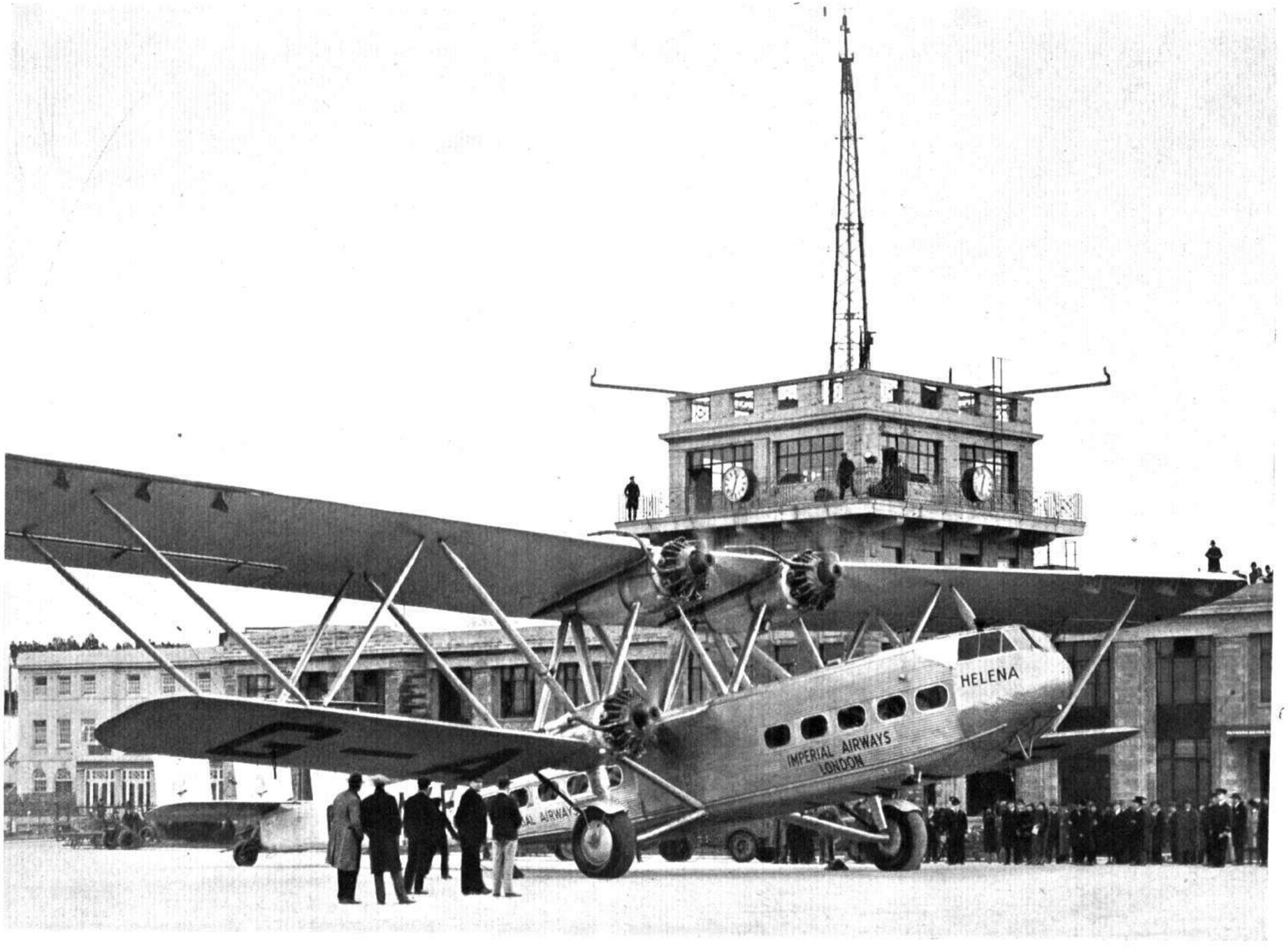
"UP"

In this issue we publish the formula chosen by the special committee formed to look into the possibility of evolving a formula on which power of aero engines can be rated. The formula makes use of the symbols "UP," and will doubtless become known as the "UP" formula. *U* represents the swept volume and *P* the engine weight, which are the two engine characteristics used for assessing the power. It was not to be expected that a simple formula like that chosen would cover adequately every possible type of engine, and, so far as we can see from a very cursory trial of it, the "UP" formula will tend to overrate the power of naturally aspirated engines and underrate that of supercharged engines. It was held that the weight of the supercharger would make up (in the formula rating) for the extra power obtained, but this does not seem to be the case. Doubtless we shall now see a great increase in the popularity of the supercharged engine on the Continent, where the naturally aspirated types have hitherto been in the majority.

THE 12.30
FOR
CAPE TOWN

(FLIGHT *Photo.*)



The first regular through air mail service between England and Cape Town started on Jan. 20. A report of the inauguration will be found on page 97.

For a Quick take-off

KLEMM aircraft have consistently been seen in this country fitted with many different kinds of engines. When they first appeared the little 2 cyl. 30 h.p. Daimler engine was fitted, after which the 40 h.p. 9 cyl. French Salmson was used, while other versions have often been seen with 80 h.p. Siemens, 95 h.p. Cirrus III, as well as the larger Hermes, Gipsy II, and Gipsy III. The latest combination, however, is that which has been effected by the Klemm Works to the order of Mr. A. B. Gibbons, and consists of a standard Klemm with the English built 7 cyl. 75/80 h.p. Pobjoy engine. We have always felt that this was a combination which would provide a really fine aircraft for the private owner, and this appears to be the case. The Pobjoy engine, being geared, allows the use of an airscrew of high efficiency and large diameter, and moreover one which "bites" immediately the throttle is open, thereby assisting the take-off very materially.

In a recent demonstration of this machine Mr. Gibbons took off from the tarmac in front of the service hangars at Stag Lane, a feat which he was allowed to do through the courtesy of the London Aero Club and De Havilland Aircraft, Ltd. On this occasion the wind was nearly directly towards the hangars, and as the hangar doors were shut there was a strong down-draught on the machine for quite a considerable distance of the take-off run. Unfortunately the wheel brakes were not in the best of order and did not allow Mr. Gibbons to rev. up the engine to any great extent before starting his take-off run. This defect, however, really enhanced the value of the demonstration, for it showed very forcibly that when the brakes are in order a take-off should be possible from the smallest of fields. Owing to the creeping of these brakes on this occasion accurate measurements were not possible, but our rough ones gave a distance of between 15 and 17 yds. from the start until the wheels were clear, which means that Mr. Gibbons was actually flying before he reached the end of the tarmac.

The power-weight ratio of this machine is very good, as, of course, readers of FLIGHT will know that the Pobjoy engine gives an exceptionally high h.p. for its low weight, and this, combined with the low wing loading of the Klemm, gives an extremely good climb. Safety is one of the features which Herr Klemm has constantly striven after, and we venture to think has attained as much, if not more, than many others; anyhow, although he has sold some 500 Klemms, there has been only one fatal accident in connection with them as far as we are aware. The model under discussion has, of course, the latest design of rudder wherein the area has been increased, and this enables the pilot to hold the machine in a side-slip without the nose dropping, as was the case with the old Klemms with their little square unbalanced rudders. On the flying characteristics we need not enlarge to any great extent, for our readers have been told all about these on many occasions. Put briefly, the Klemm is almost spin-proof, while in the present model the quick take-off, together with the extremely low landing speed and the fact that lateral control is retained even when the stick is pulled back, so that the machine is descending at a very steep angle of glide, all combine to make it one of the pleasantest aircraft we have flown. The low wing construction provides very good visibility, safety in minor crashes, and ease of handling when on the ground under conditions when any biplane or high-wing monoplane might be blown over. This Klemm Pobjoy has caused considerable excitement not only in England, but also in Germany, and the following figures justify this. These were obtained during the type test flight, when the machine was piloted by Herr Kirsch, the Klemm Company's pilot. It should be noted, however, that they have not yet been confirmed by the D.V.L.:—

Take-off run (using wheel brakes while revving up the engine), solo, 9-15 yd.; loaded (5 hr. fuel, passenger and luggage), 25 yd. Climb to 2,380 ft.; light, 3½ min.; loaded, 4½ min. Climb to 19,000 ft.; loaded, 46 min. Estimated ceiling, 21,000 ft. Cruising speed at 1,500 ft., 3,000 r.p.m.; 97 m.p.h. Top speed, 3,400 r.p.m.; 108 m.p.h. Landing speed, 23-25 m.p.h. Weights; machine empty, 750 lb.; loaded, 1,480 lb.; aerobatic loading (class S.4.K), 1,435 lb.

(*See also page* 102.)

The Klemm-Pobjoy in a tight turn around our photographer. The neat way in which the engine fits on the nose of the fuselage is well shown here. (FLIGHT *Photo.*)

The exceptional take-off of the Klemn-Pobjoy is clearly shown in this photograph. The wheels are already off the ground although there are still several yards to the end of the tarmac. (FLIGHT *Photo.*)

Disarmament and the Air

DURING the next few months the results (if any) of the International Disarmament Conference which is to be held in February should decide whether or not the nations of the world are to obtain relief from the burdens, financial and otherwise, which the maintenance of armies, navies and air forces imposes. It seems possible that some form of agreement may be reached where armies and navies are concerned, but in the air the prospects appear none too good, although Great Britain and the Empire have already done more than their share in showing the way. A programme of expansion which successive Governments regarded as essential (and which is no less vital at the present time than it was five or six years ago) has been retarded again and again in the hope (apparently vain) that other nations would follow the example. This they have not been in any hurry to do, and to-day Great Britain finds herself with an Air Force which is lamentably small in proportion to its responsibilities. That it is a very efficient Air Force is, we think, admitted the world over, and it has need to be. Geographical and climatic conditions impose heavy demands on the R.A.F., and the policy followed since the reorganisation of the Royal Air Force after the war, 1914-18, has been such as to place quality first and quantity second, both in personnel and material. Of recent years the position has been slightly improved by the re-equipment of a number of squadrons with new aircraft types, but a great deal still remains to be done before the British R.A.F. can be considered to have the equipment which modern conditions demand and the latest technical developments render possible.

In order to be able to follow with any degree of understanding the forthcoming discussions on disarmament it is essential to know with at least reasonable accuracy the air strengths of the various nations. Figures are not readily obtainable and are often of doubtful reliability when they *are* obtained. The editor and staff of our German contemporary, *Die Luftwacht*, a monthly aviation journal published in Berlin, has long made a special study of service aviation in the countries of the world, and in their January, 1932, issue they publish extensive summaries of the organisation of the air forces of most European countries as well as of the United States of America. These summaries indicate in a most admirable way the basis on which each country has organised its air service, and figures are quoted for numbers of personnel, numbers of aircraft and similar statistics. Naturally, we have no means of readily verifying the accuracy attained by our German contemporary, but it is a responsible journal and one which has a reputation for being well informed and very reliable.

It is regretted that we have not the space to publish all the statistics given by *Die Luftwacht*, but the table showing numbers of aircraft available for active service possessed by each country is thought to be of particular interest and is reproduced in full on page 93. Special attention is called to the fact that in most cases two sets of figures are given in the table. Of these the plain figures indicate figures officially submitted to the League of Nations by the country in question, while in brackets are figures obtained from a variety of other sources by *Die Luftwacht*, which journal evidently does not believe implicitly in the honesty of nations when making returns for League of Nations purposes. With no knowledge of the sources of our contemporary's information, and with scant opportunities for checking them if they were known, we naturally take no responsibility for the accuracy of the figures. It is thought, however, that they may, taken in conjunction with the " official " figures, give at any rate a rough and ready idea of the relative air strengths of the different nations. At the same time, certain comments of our contemporary occasionally help to throw a little light on its reasons for doubting the figures submitted by the respective governments to the League of Nations.

France

In dealing with France's air force organisation *Die Luftwacht* draws attention to the many changes which have taken place during the last few years, not only by the establishment in 1928 of an air ministry, but as a result of the many changes in governments and cabinets which have occurred since then. Of the air policy followed by France since M. Dumesnil became Air Minister, it is said that huge increases in the air vote were obtained, that for 1931-32 being for no less than 2,262,000,000 francs, which represented an increase of 238 million francs. Of this total figure, *Die Luftwacht* states, 76 per cent. was to go to military aviation, 11 per cent. to commercial aviation and 10 per cent. to research and prototype aircraft.

Of France's aviation personnel *Die Lutfwacht* states that the figure submitted to the League of Nations is 42,554. This is compared with a total of round about 33,000 given in previous state publications for home consumption. As new units of any magnitude formed this year are to be found in the French Colonies only, our contemporary assumes that the figures mentioned in the official documents are greatly exaggerated, the object being to ensure that if the League of Nations should prescribe a certain percentage reduction, France could agree to this and yet keep her air force at its present strength!

A similar state of affairs is found by our contemporary in the matter of material. The figures for numbers of aircraft officially supplied by France to the League of Nations are given as: At home (army) 2,321, (navy) 109 ; total, 2,430. Overseas, 570 ; grand total, 3,000 aircraft. This, it is stated, is the first time France has admitted in any official publication to have such a large number of aircraft. Our contemporary considers this figure all the more surprising in view of an official statement made a few months ago that, even including obsolete and obsolescent types, the very most France could muster was 2,600 aircraft, but points out that if one accepts the official figure of 3,000 aircraft, then to that can be added considerable numbers for machines in depôts and either in construction or about to be constructed, France's aircraft industry being planned for, and capable of, real mass production. Our contemporary thinks that a reserve of 50 per cent. would be a reasonable estimate, which would bring France's air fleet up to the astounding figure of 4,500 aircraft! It is thought that France would have no difficulty in manning such a huge air fleet, as her flying personnel was given several years ago as 5,000, of which some 4,000 were pilots.

As Others See Us

Great Britain's air power comes under the microscope of *Die Luftwacht* next. After referring to the appointment of Lord Londonderry to the Air Ministry, the journal states that the following new units were formed recently: Three active bombing squadrons at home, one " inactive " bombing squadron at home, one flying-boat training squadron, and one heavy transport flight in India. Further, for the Navy, two torpedo bomber flights.

The British air strength in machines is given as follows: At home, 180 single-seater fighters, 318 bombers, 66 reconnaissance machines, 18 communications machines, 24 experimental aircraft, and 24 flying-boats. The figures for aircraft stationed overseas are given as: 176 bombers, 60 reconnaissance machines, 6 communications aircraft, and 18 flying-boats. The Royal Navy is credited with: 48 single-seater fighters, 42 bombers, 66 reconnaissance machines and approximately 44 aircraft on board vessels. All these give a total of 1,090 aircraft, to which *Die Luftwacht* thinks one can add 50 per cent. for reserves, or 545 aircraft, and 20 per cent. for aircraft withdrawn on account of re-equipment but still capable of use, or 218 aircraft. This would give a grand total of 1,853 aircraft. These figures are our contemporary's. It quotes as the figures officially supplied to the League of Nations a total of 1,434 aircraft, which does not include the auxiliary squadrons, nor aircraft in India and the Dominions. England's declaration to the League of Nations, *Die Luftwacht* thinks, can be accepted as being in agreement with facts.

British aviation personnel is stated to have been given to the League of Nations as 42,680, while in official publications at home (presumably the Air Estimates are meant here—ED.) the figure is 46,650. Our contemporary thinks that this disproportionately large number of personnel in proportion to the number of aircraft may be due to the fact that Great Britain has to distribute some of her personnel over half the world.

Italy

According to *Die Luftwacht* Italy's air estimate for this year amounted to 753 million lire, an increase of 35 million

lire, but for all that some 50 per cent. lower than France's air estimate and 60 per cent. lower than England's.

Italy's air strength is quoted as consisting at the present time of 30 fighter squadrons, 26 bombing squadrons, these in the independent air force. The army and navy are credited with 33 reconnaissance squadrons, to which is added 10 colonial squadrons, so that Italy's air strength is assessed at 99 squadrons. The Italian declaration to the League of Nations comprises a total of 1,507 aircraft, which is compared with 1,000 aircraft hitherto given in official Italian publications. Again, our contemporary thinks there has been some play with machines of first line, reserve, etc., so that any desired proportion of effective strength may be available for disarmament purposes.

Italian aviation personnel declared in League of Nations documents total 22,193, of which 21,418 at home and 775 overseas. This figure is thought to be well below the actual, which was given in recent Italian official publications as in the neighbourhood of 29,000.

Poland

Of Poland's air arm our contemporary states that its flying strength is 700 aircraft, but that as no detailed declaration has been made it is not possible to say what percentage of these are first-line machines. Government publications of recent date have, however, indicated the first-line strength is 509 aircraft, so that the rest is probably school and training machines, spares, etc.

According to the information supplied to the League of Nations, Poland's aviation personnel totals 7,919 all ranks, but our contemporary estimates that actually the total strength is nearer 11,000, the lower figure being based on an average strength at any given time, and the actual number being greater than this.

Czechoslovakia

Comment is made on the relatively heavy air armaments of Czechoslovakia, which, in spite of the relatively small size of the country, amount to some six regiments, and the opinion is expressed that if a nation's air strength is assumed to be dictated somewhat by geographical conditions and by the strength of its neighbours, Czechoslovakia's air force must be deemed unjustifiably large. On the same basis, *Die Luftwacht* states, Germany should have an air fleet of between 4,000 and 5,000 aircraft! Statements from the press and official sources are quoted to show that the air arm in Czechoslovakia is based upon an offensive and not on a defensive policy.

The Czechoslovak declarations to the League of Nations, our contemporary claims, far exceed any figures previously published. For example, the total aviation personnel is given in the League of Nations returns as 6,482, which is claimed to be some 2,200 more than ever before shown in official documents. It is pointed out, however, that the recent establishment of 5th and 6th regiments, of approximately 1,000 each, would tend to make the official declaration tally reasonably well with facts.

Our contemporary cannot, however, find any valid excuse for the large increase in the number of aircraft. To the League of Nations Czechoslovakia has declared her air strength as 546 aircraft on the active list, and 141 school machines, or a total of 687 aircraft. In the air estimates of 1930, it is pointed out, the total of all types was given as 270, so that there has been an increase of more than 100 per cent. The view is expressed that the Czechoslovak aircraft industry would not have been able to produce this large number of machines in the time, nor, it is thought, would there be available personnel to man them. From all this our contemporary infers that Czechoslovakia, like France, is deliberately quoting too high figures, and that she is opposed to air disarmament.

Belgium

The Belgian Air Force is planned with the squadron as the unit, the fighter squadron consisting of 15 aircraft, the bombing squadron of 8 and the reconnaissance squadron of 12 aircraft. The total aviation personnel amounts to 2,840 and of military aircraft Belgium is stated to have 195, while school machines and training aircraft total 113.

Holland

Holland's air arm is divided into a home force and an overseas force. In the documents supplied to the League of Nations the home force is given as a personnel of 809 with a total of 205 aircraft, while overseas there are 116 aircraft and a personnel of 688.

Switzerland

The Swiss air strength is given in League of Nations declarations as 125 military aircraft and a permanent personnel of 258. It is pointed out that, organised on the militia system the Swiss air arm comprises three aviation divisions, with 18 flight companies and 150 aircraft, of which 96 are reconnaissance types and 54 fighters. The present programme contemplates an increase to four divisions (reconnaissance) with 24 flight companies and 192 aircraft, plus one division (single-seater fighters) with six flight companies and 54 aircraft. When this programme is completed the total strength would be five divisions with 30 companies and 246 aircraft. In 1930 the personnel included 196 officers, 499 non-commissioned officers and 2,241 men.

Spain

The Spanish air arm is at the moment in course of complete transformation. According to League of Nations figures the present strength is a personnel of 3,469 and a home fleet of 426 service aircraft, of which 392 belong to the army and 33 to the navy. Overseas Spain maitnains 108 aircraft in service. The total number of aircraft is 533.

Yugoslavia

League of Nations figures for the total personnel of army and navy air force amount to 10,810. It is pointed out that in 1930 the personnel was given officially as comprising 474 officers, 536 non-commissioned officers and 4,000 men. *Die Luftwacht* expresses the opinion that this increase, of more than 100 per cent., is either due to Yugoslavian returns covering the whole of a lengthy programme not yet terminated, or is a deliberate overstatement with future reductions in view.

Similarly in aviation material. A year ago this was given as a total of 320 aircraft, whereas the League of Nations figures show 568 first-line aircraft in the army and 59 service aircraft in the navy. It is pointed out that such an increase in the number of aircraft would have cost enormous sums of money, and that no such sums are to be found in the Yugoslav air estimates.

Roumania

According to our contemporary, Roumania followed the example of so many other nations and grossly exaggerated in her returns to the League of Nations the number of personnel and aircraft. The personnel is given as 11,836 and the aircraft as 773, whereas in January, 1931, the Roumanian Press published figures which showed the number of personnel to be 3,766 and the number of aircraft 284.

Soviet Russia

Die Luftwacht estimates that the present strength of Russia's air arm is approximately 1,800 aircraft. The air defence programme calls for some 2,000 by the end of 1932, and our contemporary thinks that this figure will be reached. No statistics are available concerning personnel.

Greece

But scant information is available concerning the Greek air arm. Our contemporary estimates that the present strength is approximately 100 aircraft and a personnel of 2,000.

United States of America

Of the air forces of the United States our contemporary has a great deal to say. It points out that the present year sees the completion of the "five years' plan," according to which America is to have 1,800 aircraft for her army and 1,000 aircraft for her navy.

According to *Die Luftwacht* the 1,800 aircraft of the army will be composed of the following types: 443 single-seater fighters; 143 bombers; 105 "battleplanes" (*Schlachtflugzeuge*); 386 observation planes; 39 amphibian observation planes; 194 school machines for *ab initio* training; 276 school machines for advanced training; 62 transport machines; and 152 observation planes of the national guard.

In view of the difficulties in training, our contemporary expresses some doubt as to whether the army air personnel of 2,200 officers and 15,000 men foreseen for 1931-32 can be attained.

Our contemporary has failed to obtain much information about the 1,000 aircraft which the United States Navy aimed at possessing by the end of the five years' plan. It thinks that possibly it is the intention to equip a considerable number of battleships and cruisers with catapults

A = Army aircraft. N = Naval aircraft. O = Aircraft in use overseas, *i.e.*, outside Mother country.
Plain figures are taken from League of Nations documents. Figures in brackets obtained from other sources.

		Active Service Aircraft of First-line (excluding Reserve).						Total First-Line Aircraft.	First-Line Reserves.	Total First-Line, including Reserve.	Second-Line, School Machines, etc. (including Reserve).	Grand Total, including all Reserves, etc.	Present Percentage of New Types (estimated).	Remarks.
		Single-Seater Fighters.	Day Bombers.	Night Bombers.	Reconnaissance	On Board Vessels.	Coastal Defence.							
France	A	(470)	(200)	(120)	(420)	—	—	1,292	430	2,117	883	3,000	40	France, it is estimated, can mobilise 4,000 aircraft at once.
	N	(30)	(72)	—	(36)	62	—							
	O	—	—	—	395	—	—	395						
Great Britain	A	(180)	(262)	(80)	(84)	—	(24)	(630) 400	(545)	(1,635)	(218)	(1,853)	70 Army	League of Nations figures do not include India, auxiliary force and Dominions.
	N	(48)	(42)	—	(66)	(44)	—	(200) 153	353	1,059	375	1,434	40 Navy	
	O	(—)	(176)	(—)	(66)	—	(18)	(260) 153						
Italy	A	(312)	(60)	(100)	(180)	—	—	(652)	?	(1,015)	757	1,507	60	—
	N	(54)	(48)	—	(157)	—	—	(259) 750		750				
	O	—	(34)	—	(70)	—	—	(104)						
Poland	A	(144)	(7)	(7)	(275)	—	—	(433)	(500)	(1,009)	(300)	(1,309)	30	Of first-line machines a certain number are school machines convertible into military types.
	N	(16)	(12)	—	(48)	—	—	(76) 700		700				
Czechoslovakia	A	(120)	(20)	(10)	(120)	—	—	(270) 546	(150)	(420)	141	(561)	40	—
										546		687		
Soviet Union	—	(290)	(160)	—	(550)	—	—	(1,000)	(800)	(1,800)	(150)	(1,950)	25	Russia has not submitted figures to League of Nations.
Belgium	A	(150)	(16)	(8)	(72)	—	—	(246) 195	(50)	(245)	113	(358)	50	—
										195		308		
Spain	A	Not known in detail						321	45	515	134	649	20	—
	N							33	8					
	O							108	—					
Jugoslavia	A	(120)	(80)	(20)	(146)	—	—	(366) 568	(50)	(677)	263	(974)	40	—
	N	(?)	(?)	(?)	(?)	—	—	(?) 59			34	924		
Rumania	A	(60)	(36)	—	(108)	—	—	(204) 573	(100)	(699)	(100)	799	20	—
	N	(?)	(?)	(?)	(80)	—	—	(80) 26						
United States	A	(443)	(248)	—	(577)	—	—	(1,268) 883	Included in First-line machines	(2,268) 1,752	(532) 599 including commercial aircraft	(2,800) 2,351	50	Figures in brackets include machines of the Five-years Plan.
	N	Cols. 1–4	total 623	(1,000)	..	164	—	(1,000) 787						
	O	Cols. 1·4	total 82	..	..	—	—	(?) 82						
Japan	A	(276)	(30)	(11)	(267)	—	—	(584) 584	554	(1,334)	? (39 school machines)	(1,373)	?	League of Nations figures, and bracketed naval figures include machines on order.
	N	—	—	—	—	(290)	(460)	(750)		1,939		1,939		
	—	—	—	—	—	329	472	800						

for launching aircraft, and to re-equip the aircraft carriers with up-to-date aircraft types.

Japan

Some comparisons are made by *Die Luftwacht* between the figures supplied by Japan to the League of Nations on September 10, 1931, and official figures previously published. The League of Nations figures were: In the army air service 584 first-line aircraft, 254 reserve aircraft, and 300 aircraft on order. In the naval air service: Aircraft for coastal defence, 472; aircraft on board vessels, 329. These give a total of 1,138 army aircraft and 801 navy aircraft, or a grand total of 1,939. Neither the army nor the navy figures includes school machines.

Our contemporary quotes figures given by the Japanese Ambassador in Berlin for aircraft in the army air service as follows: 276 single-seater fighters; 267 observation planes; 30 day bombers; 11 night bombers; and 39 school machines. Total, 623 aircraft.

Before the London Conference on Naval Disarmament (1930) the Japanese air service, our contemporary states, was given as having 270 aircraft, which by 1931 were to be increased to 340 aircraft.

The army air service personnel declared to the League of Nations is 6,944 officers and men, and the navy air service personnel is 9,877. *Die Luftwacht* considers that Japan, like several other nations, has quoted figures which include aircraft in the constructional programme extending up to 1938-39, so that if some given percentage reduction in air strength should be decided upon, Japan could considerably increase her present air strength and still be complying perfectly legally with any restrictions imposed.

Disarmament and Engine Power

AS our readers will probably be aware, the Consulting and Technical Commission on Communications and Transport (of the League of Nations) nominated a committee of experts to look into the possibilities of formulating a basis whereon the power of aero engines could be rated, the purpose being to find some equitable rating figure which could be used for the purpose of discussing limitations of aero engine power. The committee has now issued its report, and as the subject may prove of considerable importance we give a summary of the text of the report below. Chairman of the Committee was Great Britain's representative, Lt. Col. O'Gorman.

The committee, the report states, whose members approached the subject from different points of view, has succeeded after many meetings in reaching a unanimous conclusion. The committee concluded that any power formula which could not be tested without the use of a dynamometer was open to technical objections, and that no general method of dynamometer tests could give results suitable for fair comparison between engines at ground level and at altitudes. Discussions on this last point brought to light the unanimous view that no formula based upon brake mean effective pressure or permissible revolutions was to be recommended because the limiting point in each of these two factors could only be determined on the dynamometer.

Another consideration was that the formula should not hamper the improvement in engines which is constantly going on during current use, and which is closely bound up with increasing safety in flying. The amount of oxygen taken in by an engine bearing a certain relation to the power of the engine, there exists a ratio between power developed and certain dimensions of the engine, particularly the bore and stroke. There is also a ratio between the total weight of an engine and the power it can develop, a ratio arising from fundamental technical considerations relating to the construction of the engine, and which is supported by aerodynamic reasons, since an engine whose weight exceeds a certain figure is useless.

The formulæ expressing the power in terms of cubic capacity and weight are simple, and opinions were about equally divided as to which of the two was preferable. The chairman of the committee suggested that possibly the two formulæ could usefully be combined, and M. Martinot-Lagarde, who represented France on the committee, evolved a formula which, after slight modification by Prof. Kamm, was accepted unanimously.

The formula adopted is a function of the simple expression "UP," in which U represents the swept volume of the engine and P the weight of the power unit.

In more detail the "UP" formula is as follows:—

$$Wf = \sqrt{k\ Uf\ Pf},$$

where Uf is the total cylinder capacity in cubic decimetres Pf the weight, in kilogrammes, of the engine and its equipment and k is a constant. For aircraft engines the suggested value of k is 20.

It is thought that this "UP" formula will not interfere with the progress in design of aero engines, and that it will make it possible for the designer to increase bore, stroke, or both, or the weight, by sacrificing something in one direction for the gain in another so that their optima proportions can continue to be utilised. The formula, it is thought, will have the effect of encouraging designers to keep the specific weight of engines as low as possible, leaving it to the purchasing governments to ensure, by acceptance tests as at present, the necessary reliability.

Engines without reciprocating pistons have not been taken into account since, so far as the committee is aware, no such engine is at present in use, even experimentally.

Compression-ignition engines are, the report states, less severely handicapped by the "UP" formula than they would be by a simple P formula, and, moreover, it is held that these engines will take the place which they merit on account of their low fuel consumption. Two-stroke engines have also been taken into account, and the indirect limitation of weight in the "UP" formula is thought to suit also supercharged engines, the use of which the formula does not oppose.

The committee is unanimous in the view that it would have been preferable to test the accuracy of each of the three formulæ, *i.e.*, the "UP" formula, the U formula, and the P formula, by tests of a fairly large number of engines installed in their respective aircraft, in view of the effect which the adoption of any formula might have on the development of engine types. However, time did not permit of proceeding with such tests, and in the circumstances the committee feels justified in suggesting the "UP" formula as a basis for discussion, and as one which offers the minimum of difficulties.

The committee is of opinion that the use of a single power figure to apply both to aero engines and airship engines is not advisable, particularly in view of the importance in airship engines of such characteristics as efficiency and fuel economy on flights of long duration. It therefore suggests that for airship engines the "UP" formula should still be used, but the value of the constant k should be suitably reduced. It is suggested that 8 would be a suitable value.

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Car Replacements by Air

THE Automobile Association communicates the following incident showing how air transport is playing an important part as an added service to motorists. Recently an A.A. member on business in France, wrote to the headquarters of The Automobile Association in London stating that a component of his car had developed a defect; he was sending it to the Association by air from Paris, and asked the A.A. to obtain a duplicate from the manufacturers and despatch it by return to Le Bourget. The member's letter was received at 10 a.m. At midday an air liner landing at Croydon was met by an A.A. representative, and the damaged part handed over. Telephone calls to the manufacturers followed, and early the next morning the new part was soaring over the Channel on its flight to Paris. Thus within 48 hr. of the mishap the A.A. member was on his way again.

A Cardington Award

THE superintendent of the Royal Airship Works, Cardington, has presented Mr. J. J. Hamley, clerk of the works, with a long-service medal on his retirement after more than 40 years' service in lighter-than-air craft.

Private Flying & Gliding

THE HERTS AND ESSEX AEROPLANE CLUB

At Broxbourne Aerodrome there is now a steady increase in the number of hours flown, owing to the improved weather conditions. The Club has 37 flying members under instruction and 33 "A" Licence pilots. Messrs. R. Frogley, A. R. Frogley and J. Ormston are all up for their " B " Licence tests, and we wish them luck. Messrs. G. Curtis, P. Wellum, J. Griffiths, M. G. Woods, L. Walters and H. A. Macdonald, have all shown such excellent progress in the air, that, given favourable weather conditions, they will soon be ready to qualify for their "A" Licence tests.

AT THE CINQUE PORTS CLUB

Since the beginning of the year the Club has been fairly active.

The Hon. Mrs. Westenra and Mr. Mackintosh lunched at the Club on their way to Stag Lane after their amazing flight round Africa. The Hon. " Dick " Westenra flew down from Brooklands in the morning to meet his wife, and after lunch both machines left for Stag Lane. Unfortunately, the notice was too short to mass the Club Band.

Sunday, January 24, being a fine day, brought many members out to fly. In the afternoon some of them who were waiting their turn for machines were noticed doing a little " clay pigeon " shooting, the " clay pigeon " being old and well worn gramophone records. The records are still good for a lot more punishment, which does not speak well for the shooting!

Although the weather has not been kind the Club has started well this year, and the dinner and dance to be held at the Royal Pavilion Hotel, Folkestone, on Saturday, January 30, looks like being a rousing affair. The dinner is for members and friends, while the dance itself will be open to all who care to go. There is a rumour that something else will follow the dance, but so far no one seems to know what!

FLYING AT READING

An interesting visitor to the aerodrome this week was Countess de Looz-Corswarem, who flew over from Brussels in her own machine, a St. Hubert high-wing monoplane with a Walter engine ; although she has only 50 hr. to her credit, she made the journey in good time and landed successfully in a very high wind.

The Countess is one of two Belgian women pilots and is a keen airwoman ; she has been filling in her time at Reading in learning aerobatics, which apparently are not taught in civil aviation in Belgium.

The machines sold this week include a 3-seater " Spartan " to Miss Pauline Gower, one of our three " B " Licence lady pilots ; she is arranging an extensive joy-riding tour for the summer.

BROOKLANDS NOTES

Flying hours during the week ending January 23 have amounted to 35.

Mr. Pawson, a pupil who recently joined the School and is only 17 years of age, carried out his first solo flight and completed his tests for his "A" Licence. Although he commenced instruction less than three weeks ago, he has progressed remarkably well, and returns to School as an "A" Licence pilot.

Mr. Kristian Haldorsen, a pupil from Norway, has completed all his tests for his "A" Licence.

Another recruit to the ranks is Mr. C. Barker, who is still at Eton, and will continue his instruction during the next vacation.

Six pupils have been enrolled for the Blind Flying and Advanced Flying Course, full particulars of which can be obtained upon application to the Secretary of the School.

Three machines have been sold during the week to new private owners.

THE LONDON GLIDING CLUB

Easter provides a long week-end, and, to enable those enthusiasts who live far from Dunstable to take instruction, a gliding camp is being arranged by the London Gliding Club from Thursday, March 24, to Monday, March 28. The site at Dunstable is undoubtedly one of the best in the country, for even should the wind conditions be unsuitable for soaring, then auto-towing will be still possible. During this week-end not only will primary and secondary training machines be available, but also intermediate and high efficiency soaring machines. Five fully qualified instructors, each with considerable soaring experience, will cope with the pupils whom it is hoped to gather, while an extra maintenance staff will deal with repairs, should these be necessary, in a prompt manner.

Sleeping accommodation in tents holding a maximum of four persons each will be provided on the site, and meals at very reasonable prices, together with drinks, will be obtainable in the clubhouse. In the evening lectures and entertainments will be arranged. Throughout the period official observers will be ready to time tests for the Royal Aero Club glider pilots' certificates. Campers will be expected to provide their own bedding or camp beds if required. Use of tents, lamps and washing accommodation is included in the fees, which are: five days £2 10s., four days £2 8s., three days £2 2s., two days or less £1 10s. Groups of four persons sharing a tent and booking together at the same time will be allowed 10 per cent. discount, while groups of eight sharing two tents will be allowed 15 per cent. discount. These fees are payable at the time of booking, and no money can be returned under any circumstances. The club will accept full responsibility for damage to machines whilst being flown in accordance with its normal rules and regulations, also for damage to third party, but accepts no responsibility for damage or injury to pupils or pupil's personal property. The number who can be accommodated at the camp is, of course, limited, and applications will be accepted in order of receipt. Further details can be obtained from the Secretary of the London Gliding Club, Empire House, St. Martin's-le-Grand, E.C.

AN INDIAN PRIVATE OWNER: Rai Sahib Gopaldas, W.L.C., Secretary of the Nationalist Reform Party in the Punjab Legislative Council, and his Desoutter monoplane. He is the first private owner in the Punjab Province.

Airport News

CROYDON

GREAT scenes of activity marked the departure of the first Cape Town Air Mail. Numbers of notable people were present, and squads of pressmen and newsreel people thronged the departure area. After the machine had actually left, a luncheon was served at the hotel to celebrate the occasion. *Helena*, the latest H.P. 42, was the machine selected to carry this mail as far as Paris, but, according to one paper report, a day or so later this same machine was reported as having safely arrived at Athens, whereas in actual fact it was back in Croydon. However, the inauguration of this mail is fully described elsewhere in this issue, so no more need be said here.

All the H.P. 42's are now carrying the official " Royal Mail " crests when engaged on mail services, and it adds an air of distinction to the machines.

The Canadian Ice Hockey Team travelled from Paris for their match in London, and returned next morning. They chose the Air Union.

Mr. Olley left on Friday with a W.10 for Prague, carrying the corpse of a young Czecho-Slovakian who had died in London. Unfortunately, weather greatly delayed him in France.

Rumour is still very strong here regarding Imperial Airways and Air Union, and there is even talk of what might practically be taken as an amalgamation, but it is impossible to confirm or deny. I should very much doubt an amalgamation, but there seems to be something in the air in the way of mutual agreements. However, to quote the title of that present popular song, " Time alone will tell."

There are several "A" licence pilots who are waiting favourable nights in which to carry out their night flights for " B " licences. They now have to fly to Lympne instead of Penshurst as heretofore. Actually, I consider this is an easier test than flying to Penshurst, as Lympne is a really big aerodrome, where a pilot can land with confidence, and the lighting is first class, whereas Penshurst landing space is limited and the lighting cannot compare with Lympne.

Lord Halsbury, K.C., has been demonstrating the Potez again over the week-end. His Lordship is an ardent enthusiast for this machine, and he thinks it an ideal private owners' machine. I'm afraid the " Puss Moth " is a too well established favourite now for any foreign aircraft of a similar type to compete with it seriously in this country. The price would have to be decidedly tempting.

The traffic figures for the week were:—Passengers, 358 ; freight, 31 tons.

P. B.

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New Le O. Bombing Aeroplane

IT is reported from Paris that the French Air Force is about to take into service a new heavy long-distance bomber which is claimed to be superior in performance to any other machine of the type in existence. It is a biplane made by Lioré et Olivier, with four Gnome-Rhône " Jupiter " engines and having a cruising radius of action of a little over 6,000 miles, *i.e.*, 1,200 miles in a straight line, with a full load of 1,000 lb. of bombs on board.

" G.B.S." Flies

ON January 23 Mr. G. B. Shaw made a 50-min. flight from Cape Town over the Cape Peninsula. He stated it was the most thrilling experience of his 75 years.

R.A.F. 84th Wing Reunion

A REUNION dinner of the 84th Wing, R.A.F., stationed at Vendome, France, during the war, will be held on March 5, at the National Hotel, Upper Bedford Place, W.C.1. The chairman will be Capt. H. D. Briggs, R.N. Tickets from Mr. W. J. Gobey, 57, Wiverton Road, Sydenham, S.E.26.

Air Relief for Mexican Indians

LAST week 20,000 Zuñi and Navajo Indians of New Mexico were cut off from civilisation by one of the heaviest snowstorms ever known in that part of the country. Six U.S. Army bombing aeroplanes were sent from Arizona to carry relief, and succeeded in dropping approximately five tons of food into snow banks near 20 of the villages. Thus the danger of starvation was averted for the time being, and the aeroplanes continued seeking out isolated communities.

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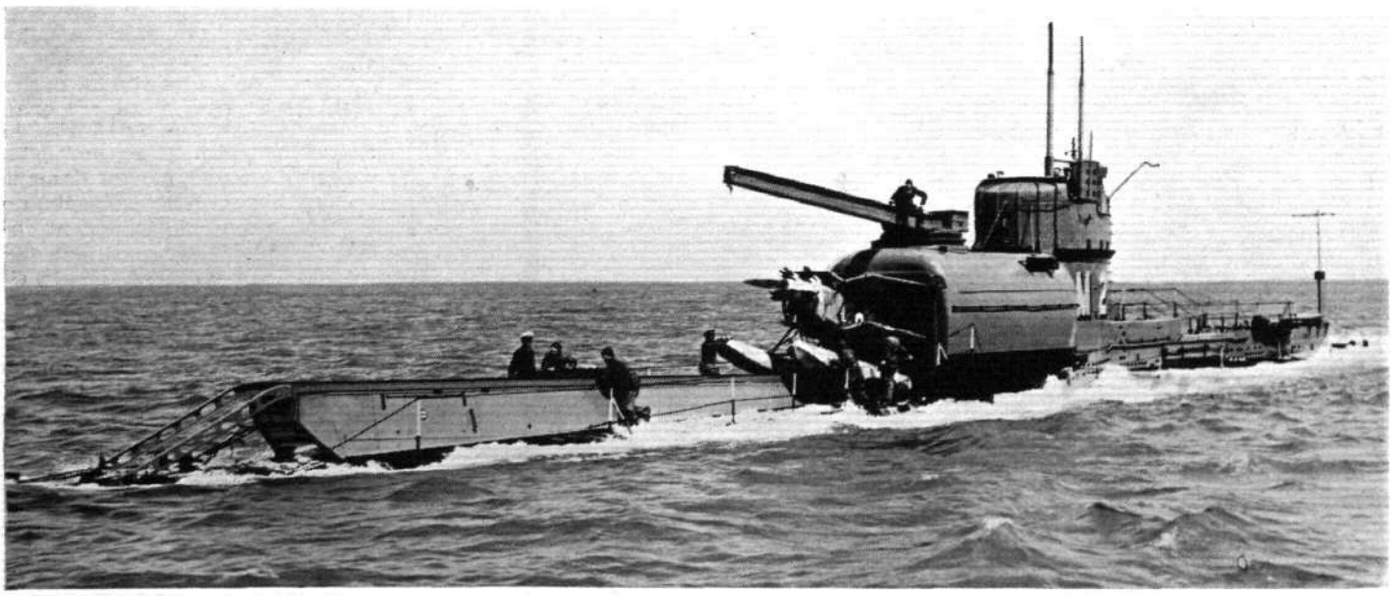

THE ILL-FATED SUBMARINE AIRCRAFT CARRIER M.2: In " Flight " for July 31, 1931, we published an account of a trip to sea in this strange form of aircraft carrier. On Tuesday, January 26, she was last seen by the Captain of a coastal steamer, who reported that she sank stern first. Up to Wednesday evening no official news had been received which gave any hope that the crew would be saved, but it was rumoured that an obstruction had been found during sweeping operations. Whether or not this was the vessel was still uncertain, and grave fears were held for the lives of the crew. (FLIGHT *Photo.*)

The AIRCRAFT ENGINEER
FLIGHT ENGINEERING SECTION

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CONTENTS

CLIMB RELATIONSHIPS

By W. R. ANDREWS, A.F.R.Ae.S.

Mr. W. R. Andrews, who is on the Technical Staff of A. V. Roe & Co., Ltd., at Manchester, will need no introduction to our readers, as he has already contributed several articles to THE AIRCRAFT ENGINEER. *In the present issue we publish the first instalment of an article on climb relationships, and by way of an introduction we do not think we can do better than quote from the covering letter which Mr. Andrews sent with the article.*

"In this comic atmosphere of ours," Mr. Andrews writes, "it often happens that a flight test result shows a high figure for initial climb and a low figure for absolute ceiling, or vice versa. There is nothing more annoying than to find later that the climb curve drawn through the scattered points has a slope not in keeping with the results obtained under ideal weather conditions.

"The suggested relationship between initial climb and ceiling gives an easy means of showing up this phenomenon, once the constant for the aircraft is known. It is surprising, too, what can be done with scattered points once one has an indication of what the result should be. This, I believe, is known as 'judicious faking'—but in bad weather one has to produce something, and the means justifies the end."

IT often happens that time or environment does not permit elaborate calculations for the change in climb relationships attendant upon a change in weight. The following notes have been compiled to facilitate the calculations in such cases.

In all cases the relationships have been expressed as formulæ for inclusion in the Engineer's Notebook. These are simple, and a slide-rule only is necessary for their computation. The chief use of the formulæ is to estimate the change in climb conditions and ceiling for a change in the gross weight of an aircraft.

For the purpose of the investigation, a hypothetical engine and aircraft have been chosen and the performance calculated for an increase in weight from 5,000 lb. to 9,000 lb. This change of weight would roughly represent the case of an aircraft flown with pilot and little fuel on the one hand and with the full load on the other.

The range of the investigation is to determine:—

(1) The climbing speed at any particular weight, knowing the speed for any other weight.

(2) The rate of climb off the ground for any weight, from the known conditions at another gross weight.

(3) The absolute ceiling in terms of the ground level rate of climb, from the rate of climb and absolute ceiling for another weight.

(4) The rate of climb and absolute ceiling in terms of the weight, engine output, airscrew efficiency and stalling speed, where test data are not available.

The hypothetical example chosen for the investigation has the following characteristics:—

1. *Engine.*

Normal airscrew r.p.m.	1,363
Normal b.h.p.	675
Maximum airscrew r.p.m.	1,500
Maximum b.h.p.	723

2. *Wings.*

The wing area is the same for all cases, viz., 539 sq. ft.

The following equivalent monoplane aspect ratios and the corresponding induced drag coefficients have been employed:—

TABLE I.

A = Aspect Ratio	=	3	6	9
K_{Di}/K_L^2	=	0·216	0·111	0·076

The wing chosen has a mean thickness to chord ratio of 0.16 and a mean camber of centre line of 0.032 c. and a $K_{L\ max.}$ of 0.705.

The estimated profile drag of such a wing is depicted in Fig. 1.

3. *Gross Weights.*

The performance has been estimated at 5,000, 7,000 and 9,000 lb. gross weight.

The choice of a thick wing was made as representing a suitable wing for manufacturing a monoplane of 9.0 aspect ratio. The thickness to chord ratio given is the mean for the whole wing; the centre portion of the wing would in all probability have a thickness to chord ratio in excess of 0.2.

The final overall drag coefficients for the three aspect ratios are shown in Fig. 2. For the sake of compactness the lengthy calculations are not included in the article, but there is nothing in them which calls for comment except the airscrew characteristics.

In making an analysis of any particular full-scale test, it is found that the estimated figures for climb are often greatly in excess of the measured performance. This is due to taking too optimistic a figure for the full-scale airscrew efficiency.

The method employed to estimate free air efficiency is one developed by the writer previously, and is described in FLIGHT (Ref. 1). The method depends upon the model test results of R. & M. 829 and the efficiencies obtained refer to the models only. The full-scale efficiency is usually about 10 per cent. less than that calculated by this method. The exact cause of the loss of efficiency of a full-scale airscrew as compared with the model may be due to scale effect, tip speed, interference, or a combination of all three.

For the tip speeds of less than about 900 ft./sec. it will be found that by reducing the efficiency to 0.9 times its estimated value much more accurate results on climb will be obtained. By efficiency, wherever it occurs in the formulæ, is meant the " net " efficiency as described in Ref. 1. The loss of efficiency between model and full scale has been allowed for in the calculations, and must be omitted when applying the formulæ.

The estimation of t.h.p. available and required at sea level and at 15,000 ft. has been made in the usual way.

Fig. 3 shows the performance with changes in the gross weight at a constant aspect ratio of 6.0.

Fig. 4 is the corresponding curve for varying aspect ratio and constant weight of 7,000 lb.

From Fig. 4 it may be erroneously concluded that the top speed of a biplane (equivalent monoplane) aspect ratio 4.0 will be slower than a monoplane of aspect 6. This, of course, would be the case if both wings were of the same section, and thickness to chord ratio. In the case chosen, the mean thickness to chord ratio is 0.16. This wing is suitable for a monoplane, but would be unsuited for a biplane of the aspect ratio suggested. A better wing for the biplane would have a thickness ratio of half this amount, especially if speed were of

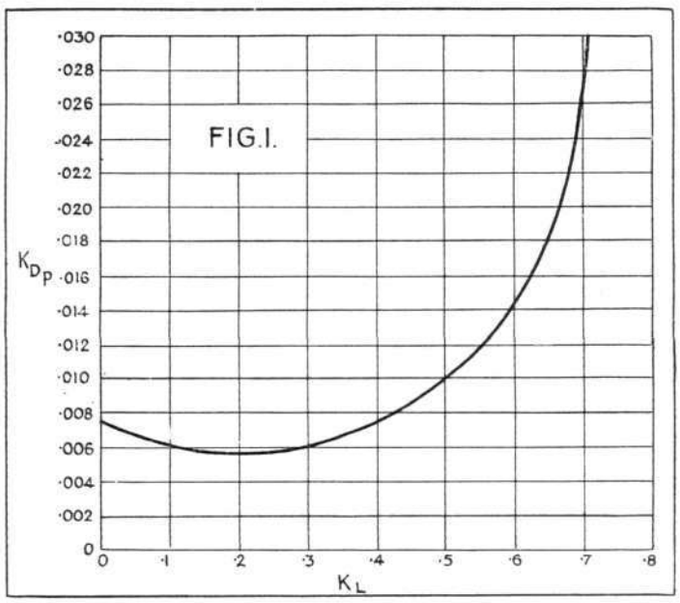


Fig. 1.—Profile Drag of Wing Section.

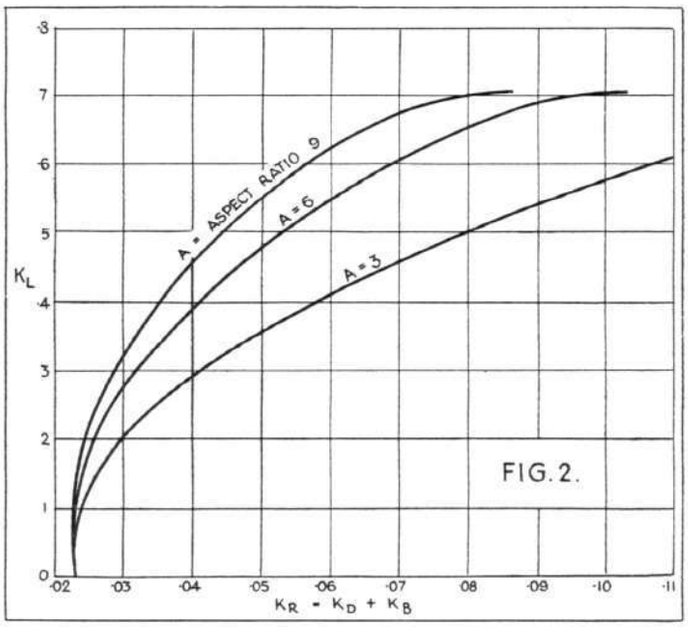
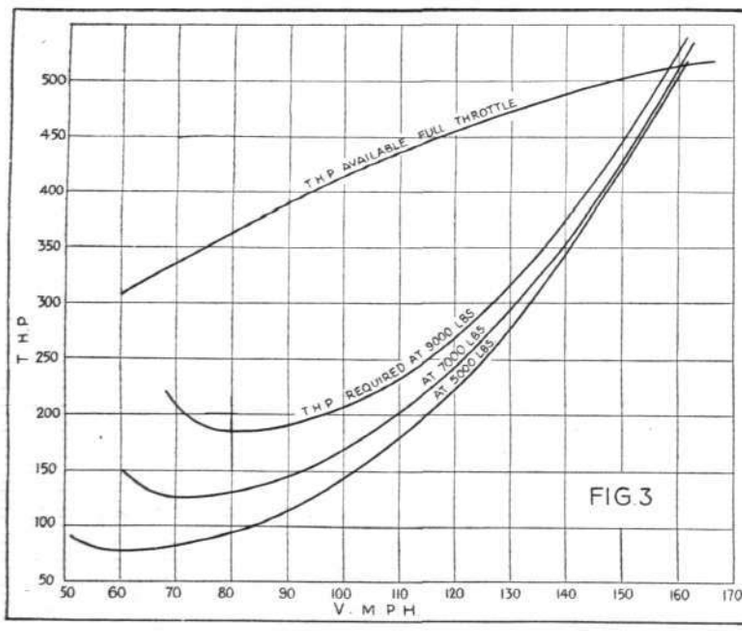


Fig. 2.—Overall Drag Coefficients. Aspect Ratios 3, 6 and 9.



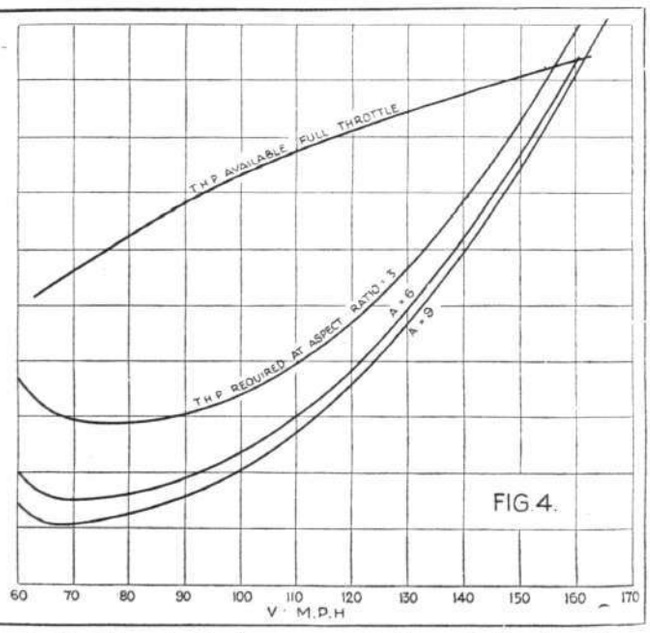


Fig. 3.—Performance at Ground Level. Aspect Ratio 6. On right, Fig. 4—Performance at Ground Level. Gross Weight 7,000 lb. Aspect Ratios 3, 6, and 9.

primary importance. However, the climbing performance is not so susceptible to small changes in thickness to chord ratio as is the top speed condition.

The induced drag forms the major portion of the wing resistance at climbing speed, and this is unaffected by profile drag.

Another point to be remembered in connection with the relative climb of monoplane and biplane is this:—

At climbing speed the thick highly cambered sections commonly used on cantilever monoplanes work nearer the point of minimum profile drag than the thinner, less highly cambered sections common to biplanes. It is possible for the profile drag at climbing speed to be less for the thick wing than for the thin wing.

The sum total of this is that climb formulæ developed for one type will apply equally well to both.

The following table gives the estimated rates of climb at ground level for the various combinations chosen:—

TABLE II.

Rates of Climb at Ground Level (ft./min.).

Apsect Ratio.	3	6	9
Weight, lbs.—			
5,000	1,630	1,830	1,890
7,000	929	1,170	1.250
9,000	470	759	857

Bairstow's formula for rate of climb (Ref. 4) can be generalised as follows:—

$$R = K_1 \left[K_2 \eta \frac{B.H.P.}{W} - V_s \right] \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where R = Rate of climb at G.L. in f.p.m.
W = Gross weight lbs.
V_s = Stalling speed.
B.H.P. = B.H.P. of engine at climbing speed.
η = "Net" airscrew efficiency.
K_1 and K_2 are constants for any aircraft.

It is fairly obvious that the values of K_1 and K_2 depend upon the L/D of the aircraft at climbing speed. The L/D is greatly influenced by the equivalent monoplane aspect ratio as well as the parasite drag of the aircraft.

TABLE III.

Aspect Ratio.	K_1	$\eta.K_2$
3	11·0	1,480
6	6·4	2,500
9	4·9	3,250

The b.h.p. taken in evaluating K_1 and $\eta \cdot K_2$ is the normal b.h.p. of the engine.

The small change in b.h.p. delivered by the engine at the various best climbing speeds is allowed for in the values of K_1 and ηK_2. For the same reason the efficiency must be kept constant, and in this case it is taken as having a value of 69.5 per cent. corresponding to the normal loaded case for the aircraft. This expedient is necessary if the formulæ are to be of use as indicated previously.

In finding the rate of climb from the known climbing conditions at another weight, it is now not necessary to estimate the new r.p.m. and corresponding b.h.p. of the engine on climb, nor, as a matter of fact, is it necessary to know the efficiency in such a case, as from known conditions the value of ($\eta \cdot K_2 \cdot$b.h.p.) can be obtained without separation. This is referred to later.

By inserting the value of 69.5 per cent. for efficiency in the last column of Table III the value of K_2 is obtained directly. The results are plotted on Fig. 5, where is will be noticed that the points do not lie on a straight line. Over that part of the curve most used, *i.e.*, from an aspect ratio of 3 to 7, the value of K_2 may be taken as having the following relationship:—

$$K_2 = 66 + 496\,A \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

Fig. 6 shows the values of K_1 plotted against the reciprocal of A. These points fall on a straight line and conform to the following law:—

$$K_1 = 1.75 + \frac{28.7}{A} \quad \ldots\ldots\ldots\ldots\ldots \quad (3)$$

The substitution of 2 and 3 in equation (1) completes the climb equation, and two suggested applications are given in the worked examples at the end of the article.

The next consideration is the climbing speed off the ground at any weight. To be of practical use the climbing speed must be expressed in quantities which can be measured on the full-scale aircraft. Two such quantities are the top speed and the stalling speed. Over a large change of weight the top speed of any aircraft is appreciably constant. As shown by Fig. 3 where for an increase in weight from 7,000 lb. to 9,000 lb. the top speed falls only 2 m.p.h.

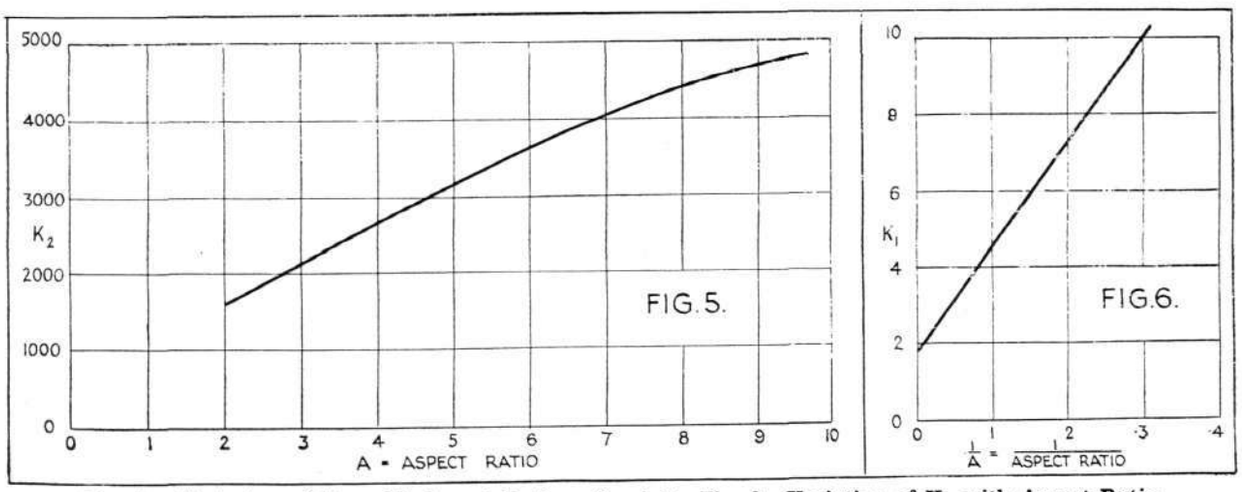


Fig. 5.—Variation of K_2, with Aspect Ratio. On right, Fig. 6—Variation of K_1 with Aspect Ratio.

The parasite drag cannot, of course, be generalised, but the effect of aspect ratio can to a great extent, thus reducing to a minimum the possible error in the estimate of rate of climb.

The values of K_1 and K_2 have been worked out to satisfy the rates of climb given in Table II.

The results are tabulated in Table III:—

Within the limits of experimental error, the following relationship holds for practical conditions of loading for any aircraft.

$$V_c \text{ (initial)} = V_s + \frac{V_m - V_s}{K_4} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

V_c = Best climbing speed m.p.h.
V_s = Stalling speed m.p.h.
V_m = Maximum level speed at G.L. in m.p.h.
K_4 = Constant for any particular aircraft.

The stalling speed of a normal biplane is based on a maximum lift coefficient of about 0.6 as compared with 0.705 for our monoplane. Therefore, when applying these formulæ to a biplane, the stalling speed for the equivalent monoplane should be inserted. The value of this fictitious speed is given by:

$$V_s \text{ (equiv. monopl.)} = V_s \text{ (bipl.)} \sqrt{\frac{0{\cdot}6}{0{\cdot}705}} = 0{\cdot}92\ V_s \text{ (bipl.)}.$$

This equivalent monoplane speed is then used for equations 1 and 4.

From the results of Fig. 3 the following table is compiled:—

TABLE IV.

Weight lbs.	V_m	V_s	V_c	$V_m - V_c$	$V_c - V_s$	K_4
5,000	160·9	50·7	90·2	110·2	39·5	2·79
7,000	160·0	60·0	95·5	100·0	35·5	2·81
9,000	158·0	68·0	101·1	90·0	33·1	2·72

The point of maximum rate of climb is hard to fix to within ±2 m.p.h. on full-scale tests, or by estimation.

The small variation of K_4 shown in Table IV is, therefore, negligible, so that K_4 has a value of 2.77 for an aspect ratio of 6, and an airscrew designed as the one in the example.

The change of K_4 with aspect ratio is of no particular interest, except for the estimation of best climbing speed where no previous tests are available.

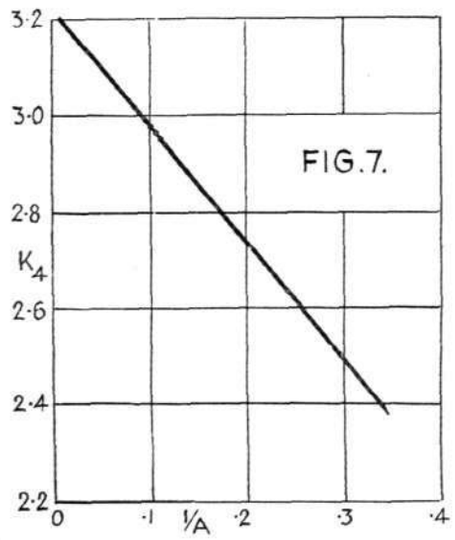


Fig. 7.—Variation of K_4 with Aspect Ratio.

Table V and Fig. 7 give this variation of K_4 with aspect ratio, from which it is found that

$$K_4 = 3.22 - \frac{2.44}{A} \quad \ldots\ldots\ldots\ldots\ldots \quad (5)$$

From these relationships it is now possible to determine the best climbing speed at standard ground level for any loading from the known performance at any other gross weight.

TABLE V.

A	V_m	V_s	V_c	$V_m - V_s$	$V_c - V_s$	K_4
3	156·7	60	100·0	96·2	40·0	2·41
6	160·0	60	95·5	100·0	35·5	2·81
9	161·8	60	94·5	101·8	34·5	2·95

REFERENCE.

1 "The Calculation of Airscrew Characteristics." FLIGHT, February 20, 1931. See also "Handbook of Aeronautics."

(*To be continued.*)

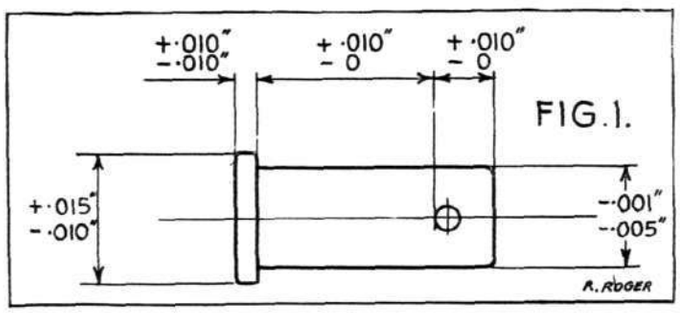
LIMITS, FITS AND ALLOWANCES.

By R. RODGER.

(*Continued from page 95 of December 25, 1931, issue.*)

Shackle Pins

The general limits for shackle pins are indicated in Fig. 1 and call for no further comment.



Rivet Blanks

In practice it has been found that in order to obtain the best form of head it is necessary to have the length of the rivet blanks equal to the grip plus 1.5 D, where D is the rivet diameter. This applies to all forms of rivets, both in steel and duralumin.

Hole Centres

Centres of bolt holes in timber should be within ±0.015 in. of the nominal dimension, and in metal fittings within ±0.010 in. of the nominal dimension.

Overall Lengths

The overall lengths of timber spars, struts, etc., over 3 ft. long should be within ±0.010 in. per foot run, and lengths of 3 ft. and under should be within ±0.030 in.

The overall lengths or pin centres of metal spars, struts, etc., over 5 ft. long should be within $\pm\frac{1}{32}$ in. of the nominal dimension, and lengths of 5 ft. and under should be within $\pm\frac{1}{64}$ in.

Hinges

The general practice adopted to ensure interchangeability in a family of hinges is to control side play by location at a master, or datum, hinge covered by fine

TABLE V.

Limits on Hinges.

Master Hinge.		Hinge Centres. L.	Auxiliary Hinges.	
Male. X.	Female. Y.		Male. X.	Female. Y Min.
− 0·001 − 0·005	+ 0·001 + 0·005	± 0·030 —	− 0·001 − 0·005	+ 0·070 − 0·0

limits, allowing ample clearance in the female portions of the auxiliary hinges to cover discrepancies in hinge centres. Suitable limits for hinges are given in Table V, which warrants a little further discussion.

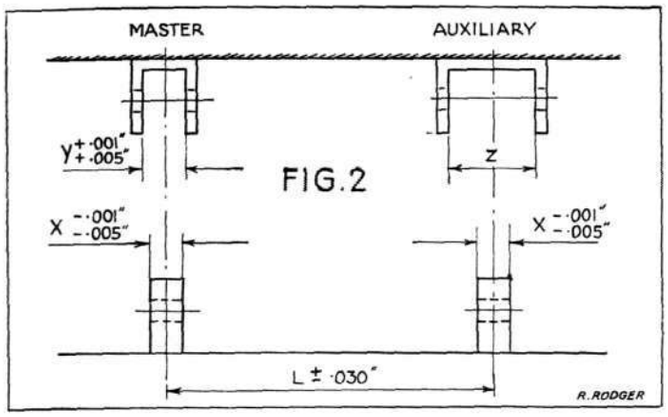


FIG.2

Consider the pair of hinges—master and auxiliary—shown in Fig. 2. The dimension Z must be sufficient to cater for:—

(i) The tolerance in the master hinge.
(ii) The tolerance on the hinge centres.
(iii) The *maximum* thickness of the male portion of the auxiliary hinge.
(iv) A reserve clearance, say 0.001 in.

Thus, the tolerance on Z = Y must be

$$0.010 + 0.060 - 0.001 + 0.001 = 0.070 \text{ in.}$$

Hence, the *minimum* size for Z must be Y $^{+0.070}_{-0.0}$ in.

In practice it is usual to exceed this tolerance and give ample clearance.

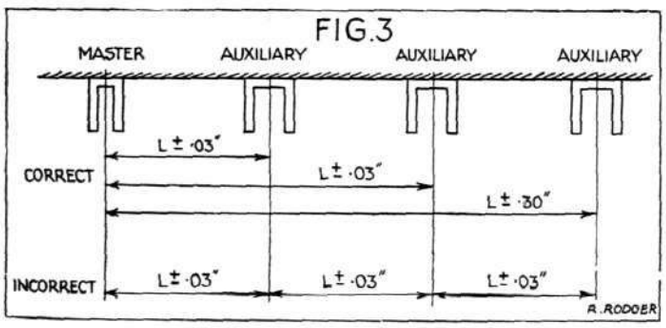


FIG.3

In order to avoid duplication of tolerances all hinge centres should be referred to a common datum—the master hinge—as shown in Fig. 3. This practice should, in fact, be made general for all classes of work where duplication of tolerances may arise.

Plate Fittings

The limits of error on the general dimensions of the profile of sheet metal fittings where interchangeability is not involved should be within nominal size and plus $\frac{1}{64}$ in.

The thickness of sheet metal used for small fittings such as wiring lugs, etc., should not differ from the specified nominal thickness by more than the amounts quoted in column 2 of Table VI. For large sheets over 3 ft. wide to be used for pressings, etc., the tolerances may be increased to the values quoted in column 3 of the table.

The stock delivered from the rolling mills is fairly consistent as regards thickness within the limits stated, but, nevertheless, the practice of "weeding" sheet metal is to be recommended. Thick sheets should be set aside for the manufacture of fittings involving welding as a production process, the resultant scaling and reduction in gauge thus being offset to some extent.

Several years ago the writer conducted a series of

TABLE VI.
Sheet Metal.

Imperial S.W.G.	Small Sheets 3 Ft. and Under.	Large Sheets over 3 Ft. Wide.	Bend Radii.	
	On Nominal Thickness. — 0.	On Nominal Thickness. — 0.	Low-Tensile Steel.	H.T. Steel and Dural.
6	+ 0·012	+ 0·014	$\frac{5}{16}$	$\frac{3}{8}$
8	+ 0·012	+ 0·014	$\frac{1}{4}$	$\frac{5}{16}$
10	+ 0·010	+ 0·012	$\frac{3}{16}$	$\frac{1}{4}$
12	+ 0·010	+ 0·012	$\frac{5}{32}$	$\frac{3}{16}$
14	+ 0·006	+ 0·008	$\frac{3}{32}$	$\frac{5}{32}$
16	+ 0·006	+ 0·008	$\frac{1}{16}$	$\frac{3}{32}$
18	+ 0·006	+ 0·008	$\frac{1}{16}$	$\frac{3}{32}$
20	+ 0·005	+ 0·007	$\frac{1}{32}$	$\frac{1}{16}$
22	+ 0·005	+ 0·007	$\frac{1}{32}$	$\frac{1}{16}$
24	+ 0·003	+ 0·005	$\frac{1}{32}$	$\frac{1}{32}$
26	+ 0·003	+ 0·005	$\frac{1}{32}$	$\frac{1}{32}$

experiments to determine the most suitable bend radii and allowances for different gauges and materials, samples of S.3, S.4 and L.3 being utilised. From the results, the inside radii for bends were graded to linear laws according to gauge of plate and nature of material, the following expressions being derived therefrom:—

(i) *For Low Tensile Steel.*

$$R = 1.9T - 0.05$$

with low limit,

$$R = 0.03 \text{ in. for } T \leq 20 \text{ S.W.G.}$$

(ii) *For High Tensile Steel and Duralumin.*

$$R = 2.1T - 0.025$$

with low limit,

$$R = 0.03 \text{ in. for } T \leq 24 \text{ S.W.G.}$$

where

R = inside radius of bend, in inches, and
T = nominal thickness of plate, in inches.

The bend radii quoted in Table VI are calculated from these formulæ, but for practical reasons are given to the nearest $\frac{1}{32}$ in.

With these bend radii, the bending allowance may be expressed as a function of the bend angle and the plate thickness, irrespective of material, thus:

$$BA = \frac{\theta}{360}(6.3R + 2.5T)$$

where

BA = bending allowance, in inches,
θ = angle of bend, in degrees, and
R and T are as before.

Tubing

The external profile of round and square tubing should be within the limits stated in Table VII. The

TABLE VII.
Tubing.

Profile of Round or Square Tubing.		Wall Thickness All Tubing.	
Diameter or Flats.	Limits.	S.W.G.	Limits.
In.			
Up to $1\frac{1}{2}$	± 0·003	10	± 0·013
$1\frac{9}{16}$–2	± 0·004	12	± 0·013
$2\frac{1}{16}$–$2\frac{1}{2}$	± 0·005	14	± 0·009
$2\frac{9}{16}$–3	± 0·006	16	± 0·007
$3\frac{1}{16}$–$3\frac{1}{2}$	± 0·007	17	± 0·006
$3\frac{9}{16}$–4	± 0·008	18	± 0·006
$4\frac{1}{16}$–$4\frac{1}{2}$	± 0·009	20	± 0·005
$4\frac{9}{16}$–5	± 0·010	22	± 0·004
		24	± 0·003
		26	± 0·003

external profile of oval and streamline tubing may be covered by a general limit of ±1 per cent. on the nominal major axis and ±½ per cent. on the nominal minor axis.

The wall thickness of stock tubing cannot be guaranteed to a finer limit than ±10 per cent. on the nominal Imperial S.W.G., and if more accurate workmanship is required, maximum and minimum wall thicknesses must be specified, the product then being regarded as special tubing.

Trapped ends of tubular frame members should always be reinforced by a liner of at least the same gauge as the main tube and of such length that at least three diameters remain untrapped in the reinforced tube. The liner should be serrated over a length of 1¼ diameters from the untrapped end.

Machined Parts

(i) *Plug Ends.*—These are difficult to standardise owing to the comparatively coarse manufacturing limits called for by the tube makers. The most satisfactory method would appear to be that of rough turning the shanks in quantities to the nominal bore of the tube $^{+0.04}_{-0.0}$ in., then fitting to every individual tube by a final skim. This means, of course, that tubular struts, etc., must be delivered as spares complete with plug ends pinned in position.

(ii) *Socket Ends.*—Similar remarks apply in general to socket ends for tubular struts, but as the profile of a tube is more certain than its wall thickness for the majority of sizes, a finer rough turning limit may be applied to the bore of the socket, say $^{+0.0}_{-0.015}$ in For this reason the use of socket ends where possible may be preferable.

(iii) *Spigots.*—Where two or more machined parts are fixed together by a group of common bolts, the use of spigots is to be recommended where possible. This practice permits of the outermost part being drilled to drawing, the whole group of parts being then spigotted together and drilled from the outermost part as a template. The unit may thus be drilled on the bench with certainty of marrying up when assembled on the job. The note "Drill on assembly" appears on aircraft drawings far too frequently and should be discouraged, as hand finishing on the job generally has to be accomplished under distinctly unfavourable conditions and is, accordingly, wasteful of man-hours.

(iv) *Fork End Clearances.*—This is another item involving hand finishing on the job and one for which there is no excuse, being due to careless design. At least $\frac{1}{16}$ in. clearance should be allowed on forked parts between the commencement of fillets and the radii round the pin holes, as indicated in Fig. 4.

(v) *Adjustable Ends.*—Adjustment on the pin centres of tubular struts is to be recommended. Where such adjustment is provided, it need only occur at one end, the range being of the order of ±¼ in. To facilitate the inspection of such ends when assembled on tubes, a

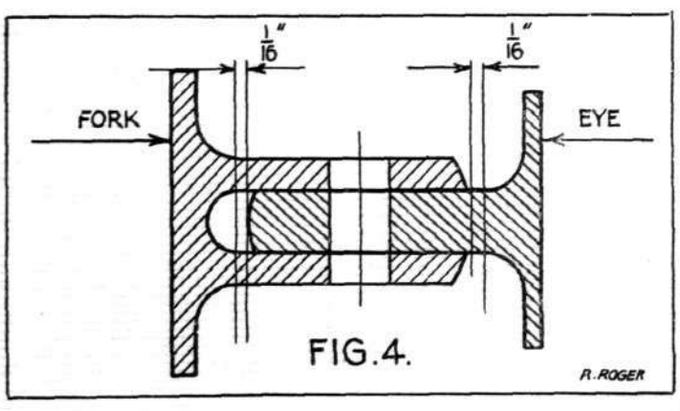


FIG. 4.

TABLE VIII.

B.S.P. Hexagons.

B.S.P. Thread.	Hexagon Flats.	
	Max.	Min.
⅛	0·525	0·520
¼	0·600	0·595
⅜	0·820	0·815
½	0·920	0·915
⅝	1·010	1·002
¾	1·200	1·192
⅞	1·300	1·292
1	1·480	1·468
1¼	1·670	1·658

$\frac{3}{32}$ in. diameter inspection hole should be drilled in the socket in such a position that when the end of the screwed plug is opposite the hole the length of thread still engaged is at least 1¼ plug diameters. This will correspond to maximum pin centres.

(vi) *B.S.P. Hexagons.*—Machined parts with B.S.P. threads, *e.g.*, double-end pipe couplings, etc., should be provided with Whitworth hexagons to allow the use of standard spanners. The appropriate sizes are given in Table VIII.

Castings

The general limits of error on:—

(i) The thickness of castings where not machined should be within the nominal thickness and plus 10 per cent.

(ii) The thickness of castings where machined on one side only should be within the nominal thickness and plus 5 per cent.

(iii) Where machined on both sides apply the general limits of Table I.

As regards the thickness of light alloy castings the writer would suggest a minimum of ⅛ in. to guard against blow-holes, porosity, etc. He is aware that thinner castings in light alloy, *e.g.*, alpax, are used, but he never feels very happy concerning same.

Whenever cast wheels, *e.g.*, steering wheels, which are a proprietary design and for which no specification exists, are called for on a drawing, a definite maximum safe torque applied at the periphery of the wheel, the boss being held, should be stated on the drawing. This torque should form the criterion for the acceptance of the wheel.

Ball Bearings

Ball bearings are manufactured to very fine tolerances and considerable care should be exercised when fitting.

A bearing that is too loose on its spindle will tend to creep, whilst an inner race forced too tightly on to the spindle will be distorted by expansion, thus altering the internal fit of the balls and giving false working conditions.

TABLE IX.

Ball Bearings.

Size.	Limits.	
	Shaft.	Housing.
In.		
⅜–¾	+ 0·0005	—
	+ 0·0001	—
⅞–1⅛	+ 0·0006	− 0·0003
	+ 0·0001	+ 0·0012
1⅛–2	+ 0·0007	—
	+ 0·0002	—

Similar remarks apply to outer races improperly housed. If the fit is too tight the outer race may be pinched or buckled with detrimental results, and if too loose creep may again arise.

In aircraft practice the loads are usually light and creep does not entail serious consequences, but the excessively tight fits must always be avoided. If the best results are desired the bearing manufacturers' tolerances should be worked to, and where possible selective assembly finally used. In the absence of such data the limits quoted in Table IX may be used with confidence.

Where a shaft has multiple radial bearings, axial thrust due to mal-alignment should be eliminated by making the inner races a light driving fit on the shaft, leaving all the outer races but one floating endwise and free to creep axially.

TABLE X.

Wheels and Axles.

Dimension.	Limits. In.	Limits. Mm.
Length of wheel hub over bush faces	+ 0·0 − 0·05	+ 0·0 − 1·25
Length of axle journal	+ 0·05 + 0·01	+ 1·25 + 0·25
Bore of wheel-hub bushes	+ 0·03 + 0·01	+ 0·75 + 0·25
Diameter of axle journal	+ 0·0 − 0·01	+ 0·0 − 0·25

Wheels and Axles

The general limits applicable for ensuring the interchangeability of wheels and their axles are given in Table X, while the safe static loads for wheels of various sizes are quoted in Table XI, the values being deduced from the formula

$$W = kDd$$

where

W = safe static load per wheel, in lbs.
D = wheel diameter, in inches.
d = tyre diameter (tread), in inches.
k = a constant of value 12.

The loads so deduced give a load factor in the neighbourhood of 5 for the static condition and are based on a tyre inflation pressure of 50 lbs./sq. in.

Angles

The limits of error on the angular setting of lugs, sockets, etc., should be within $\pm\frac{1}{2}$ deg.

Both apparent and true angles should be shown on the drawing to assist the setter-up, or marker-off, and inspectors in the shops, as it is usual practice to check fittings having lugs set at one or more angles on a surface plate. The true angle should be checked by setting up the fitting in its true position by the use of a universal bevel protractor.

TABLE XI.

Static Loads for Aero Wheels (Civil Aircraft).

Wheel Size. Mm.	Wheel Size. In.	Static Load. Lb.	Wheel Size. Mm.	Wheel Size. In.	Static Load. Lb.
375 × 55	14·75 × 2·165	380	750 × 125	29·55 × 4·92	1,740
300 × 60	11·80 × 2·36	340	800 × 150	31·50 × 5·90	2,230
450 × 60	17·72 × 2·36	500	1,000 × 150	39·40 × 5·90	2,790
575 × 60	22·62 × 2·36	640	1,000 × 180	39·40 × 7·09	3,350
650 × 65	25·60 × 2·56	790	900 × 200	35·40 × 7·88	3,350
600 × 75	23·60 × 2·95	840	1,100 × 220	43·30 × 8·65	4,490
700 × 75	27·55 × 2·95	980	1,250 × 250	49·20 × 9·85	5,810
700 × 100	27·55 × 3·94	1,300	1,500 × 300	59·00 × 11·82	8,380
650 × 125	25·60 × 4·92	1,510	1,750 × 300	68·90 × 11·82	9,780

These loads give a factor of five.
Tyre-inflation pressure = 50 lb. per sq. in.

Sections

The geometry of sections of such items as spars, struts, etc., should be within the nominal size and plus 0.03 in.

Assemblies

A clearance of $\frac{1}{2}$ in. should be allowed at the gap between the inner end of the ailerons and the adjacent wing structure, and also between the aileron structure and the faces of the outriggers where backward-hinge balance is employed. A similar clearance should be allowed for the horn balance of rudders and elevators.

It may be of interest to record here that as a result of glueing four thicknesses of fabric together, the writer has found that the total thickness of same is 0.05 in.

Power Unit

(i) *Oil System.*—As general *minimum* figures, the air space in oil tanks should be 2 gallons for water-cooled engines and 1 gallon for air-cooled engines.

The filter should be so located that it is impossible to fill the tank beyond 90 per cent. of its total capacity or, alternatively, above the level giving the air spaces quoted above, whichever is the greater.

Tanks should be tested to a pressure of 5 lbs./sq. in.

(ii) *Fuel System.*—Fuel systems should be capable of delivering 100 per cent. in excess of engine requirements at full throttle.

Tanks should be tested to four times the static head when the tank is full or $2\frac{1}{2}$ lbs./sq. in., whichever is the greater. In special cases, such as that of large aircraft not subject to rapid accelerations, it may be possible to relax these requirements to, say, $1\frac{1}{2}$ lbs./sq. in., but each case should be considered on its individual merits.

(iii) *Water System.*—The minimum clearance between engine and radiator should be $\frac{3}{8}$ in., between shutter and radiator $\frac{1}{4}$ in., and between shutters and airscrew $\frac{5}{8}$ in.

Conclusion

Although this paper contains a fairly comprehensive list of limits applicable to aircraft construction, it is not by any means exhaustive or, for that matter, authoritative, and numerous omissions will, no doubt, occur to readers. For such omissions the author offers his apologies, and in so doing submits that his statement of limits may at least serve a useful purpose as a basis for standardisation, a matter which, in his opinion, is somewhat overdue.

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any Bookseller.

EXPERIMENTS ON A MODEL OF THE AIRSHIP R.101 WITH APPLICATIONS TO DETERMINE THE STEADY MOTION OF THE AIRSHIP. By R. Jones, M.A., D.Sc., and A. H. Bell. R. & M. No. 1400 (Ae. 521). (31 pages and 17 diagrams.) May, 1931. Price 1s. 9d. net.

The investigations described in the following pages arose out of a request from the Court of Inquiry into the disaster to the Airship R 101 for experiments to be conducted on a model of the airship with the extra bay inserted. Experiments which had been previously conducted were carried out on a model of fineness ratio 5·5 to 1 in connection with the original design of the airship. This model corresponded to the airship without the extra bay, and experiments upon it have been described in R. & M. 1168 and 1169.*

* Experiments on a model of the airship R. 101.—Jones and Bell.

Certain other modifications had been introduced into the design of the airship since the models used in the earlier work were constructed. These modifications will be discussed later, but it may be stated that the addition of the bay in itself was a sufficient justification for desiring further experiments on a model of the airship as she was before starting on her last flight.

The lift, drag and pitching moment were measured on a model at angles of pitch varying from + 20° to − 40° with the elevators set over a range of angles between ± 25°. M_y was measured at various angles of pitch from 0° to − 40° approximately. Additional observations of cross-wind force, drag and yawing moment, with the control surfaces amidships, were taken at angles of yaw ranging from 0° to 20°. Data for examining the efficiency of the hull, fins and control surfaces were also obtained.

The results have been applied to determine the conditions under which the ship would fly steadily along rectilinear paths inclined at angles ranging from 0° to − 30° to the horizontal, assuming the engines to develop a constant B.H.P. consistent with a speed of 55 knots in head-on flight. The effects of gas leakage from a forward gas-bag, increased drag or decreased airscrew thrust have been considered. A brief discussion of the stability is also included.

A comparison of the model results with those of earlier experiments before the extra bay was included show that the hull characteristics have undergone some change owing to the bay and also to the introduction of fifteen reefing girders. A modification in the design of the fins and control surfaces have given rise to appreciable changes in control efficiency.

The equilibrium calculations show that the ship had ample control surfaces for keeping the axis of the ship pointing upwards at the nose even after (1) a considerable gas leakage forward, (2) a possible damage to the outer cover had caused an increase in the drag, or (3) a decrease in the thrust.

The ship appears to have been provided with stabilising surfaces of sufficient area to satisfy the usual stability criterion.

WIND TUNNEL TESTS ON HIGH TIP SPEED AIRSCREWS. FURTHER EXPERIMENTS ON SCALE EFFECT. By A. S. Hartshorn, B.Sc., and G. P. Douglas, D.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1417 (Ae. 538). (17 pages and 9 diagrams.) May, 1931. Price 1s. net.

The present experiments continue the investigation into the effects of high tip speeds on airscrew performance and were designed to find if the results which had been obtained for model airscrews were modified when the size of the airscrew was increased.

An airscrew having blades geometrically similar but 50 per cent. larger than those of a model airscrew previously tested was made up. The blade section was of conventional form 10 per cent. thick. Comparative measurements of overall thrust and torque have been made and also of the thrust and torque grading.

The results indicate that with this airscrew the compressibility stall is mainly dependent on radius rather than on the size of the airscrew. The effect of the 50 per cent. increase in scale appears to delay the compressibility stall about 0·02 of the speed of sound.

THE USE OF MODELS FOR THE DETERMINATION OF CRITICAL FLUTTER SPEEDS. By W. J. Duncan, D.Sc., A.M.I.Mech.E. R. & M. No. 1425 (Ae. 545). (5 pages.) July, 1931. Price 4d. net.

The use of model tests in the prediction of full-scale critical flutter speeds is now well established, and the technique of such tests is therefore worthy of discussion. In order to obtain critical speeds for the model within the speed range of ordinary wind tunnels it is necessary that the model should differ in some respects from a mere small-scale replica of the full-scale aeroplane. In the method originally suggested by McKinnon Wood the modification of the model consists in a reduction of its effective stiffness. This method has the defect (in most cases probably not serious) that the model experiment is conducted at a Reynolds' number much below that for full-scale. In the present paper it is pointed out that an alternative method of reducing the critical speed is to increase the mass loading of the model and to make the flutter tests in compressed air. It is then quite feasible to reach the full-scale Reynolds' number. This method of reducing the critical speeds by a proportionate increase of all effective densities may also be combined with a reduction of the elasticity of the model.

The relation of model and full-scale stresses at the critical flutter speeds is considered. Where the reduction in critical speed is effected by increase of density only, the model and full-scale stresses are equal. In a model of reduced elasticity the stresses in the wires are the same as for full-scale, whereas, the stresses in the spars are less than for full-scale. This is in accord with the usual experience that the wires of such a model are the first parts of the structure to fail in a flutter.

Lastly, the influence of gravity on flutter is considered. This is negligibly small for full-scale, but not necessarily so for the model. Gravitational effects can sometimes be corrected by suitable orientation of the model.

SUMMARIES OF N.A.C.A. TECHNICAL REPORTS

The National Advisory Committee for Aeronautics is the American equivalent of our Aeronautical Research Committee, with headquarters at Washington, D.C. The Technical Reports issued by the N.A.C.A. are obtainable from the Superintendent of Documents, Washington, D.C., U.S.A. In the summaries printed below the prices of Reports are given. These prices are net, and a small amount should be added to cover postage. For the guidance of potential purchasers it may be pointed out that the Reports rarely exceed 5 oz. in weight.

No. 391. THE AERODYNAMIC CHARACTERISTICS OF EIGHT VERY THICK AIRFOILS FROM TESTS IN THE VARIABLE DENSITY WIND TUNNEL. By Eastman N. Jacobs. Price 10 cents.

A group of eight very thick aerofoils having sections of the same thickness as those used near the roots of tapered aerofoils were tested in the Variable Density Wind Tunnel of the National Advisory Committee for Aeronautics. The tests were made to study certain discontinuities in the characteristic curves that have been obtained from previous tests of these aerofoils, and to compare the characteristics of the different sections at values of the Reynolds number comparable with those attained in flight. The discontinuities were found to disappear as the Reynolds number was increased. The results obtained from the large-scale tests in this series indicate that the N.A.C.A. 0021 aerofoil, a symmetrical aerofoil having a thickness ratio of 21 per cent., has the best general characteristics.

No. 400. THE AERODYNAMIC CHARACTERISTICS OF A SLOTTED CLARK Y WING AS AFFECTED BY THE AUXILIARY AIRFOIL POSITION. By Carl J. Wenzinger and Joseph A. Shortal. Price 15 cents.

Aerodynamic force tests on a slotted Clark Y wing were conducted in the vertical wind tunnel of the National Advisory Committee for Aeronautics to determine the best position for a given auxiliary aerofoil with respect to the main wing. A systematic series of 100 changes in location of the auxiliary aerofoil were made to cover all the probable useful ranges of slot gap, slot width, and slot depth. The results of the investigation may be applied to the design of automatic or controlled slots on wings with geometric characteristics similar to the wing tested.

An increase of 41·5 per cent. in the maximum lift above that of the plain wing was obtained for the slotted Clark Y wing. At the same time, the angle of attack for maximum lift was increased 13°. It was found that a maximum increase of about 30° was possible in the highest stalling angle, but at a maximum lift coefficient slightly less than that of the plain wing. However, with one slot position, an increase of 25°, together with an increase in the maximum lift coefficient of 23·3 per cent. was obtained. The best positions of the auxiliary aerofoil were covered by the range of the tests, and the position for desired aerodynamic characteristics may easily be obtained from charts prepared especially for the purpose.

MECHANICAL PROPERTIES OF NICKEL ALLOY STEELS.

THIS is the title of an extremely useful booklet issued by the Mond Nickel Co., Ltd. The compilers have endeavoured to present in a convenient form a summary of the mechanical properties obtainable from various nickel alloy steels. Many steels containing from 1 to 5 per cent. of nickel are now available, and in each of these a variety of properties may be obtained by suitable heat-treatment. A limited number of well-known and widely accepted official specifications have been taken as a basis. Some of these are for aircraft and automobiles issued by the B.E.S.A., and reference is made also to others published by the Directorate of Technical Development, Air Ministry.

Details of the chemical composition, heat-treatment and mechanical tests are tabulated, as are also such typical properties of the core as chemical composition, refining and hardening quenching temperatures, results of mechanical tests such as yield point, maximum stress, elongation, reduction of areas, and Izod impact figures. The first part of the booklet deals with nickel and nickel-chromium case-hardening steels, while in the latter part tempering curves for a number of steels are given. These curves, it is stated, are based upon figures which represent the averages of a large number of test results.

The choice of a suitable steel for any particular purpose depends, of course, on a number of factors, and these have to be taken into account in using the curves. In the curves the figures are based on test pieces machined from $1\frac{1}{8}$-in. bars, and, strictly speaking, the curves apply only to parts of approximately this section.

To give an idea of the range covered by the booklet it may be of assistance if we give a list of the steels included:—3 per cent. nickel case-hardening steel; 5 per cent. nickel case-hardening steel; nickel-chromium case-hardening steel ($3\frac{1}{2}$ per cent. nickel); nickel-chromium case-hardening steel ($4\frac{1}{4}$ per cent. nickel); 1 per cent. nickel steel (*a*) oil hardened and tempered; (*b*) water hardened and tempered; 3 per cent. nickel steel, oil hardened and tempered; $3\frac{1}{2}$ per cent. nickel steel, oil hardened and tempered; 55 ton nickel-chromium steel, oil hardened and tempered (*a*) without molybdenum; (*b*) with molybdenum; 65 ton nickel-chromium steel, oil hardened and tempered; air-hardening nickel-chromium steel, air hardened and tempered.

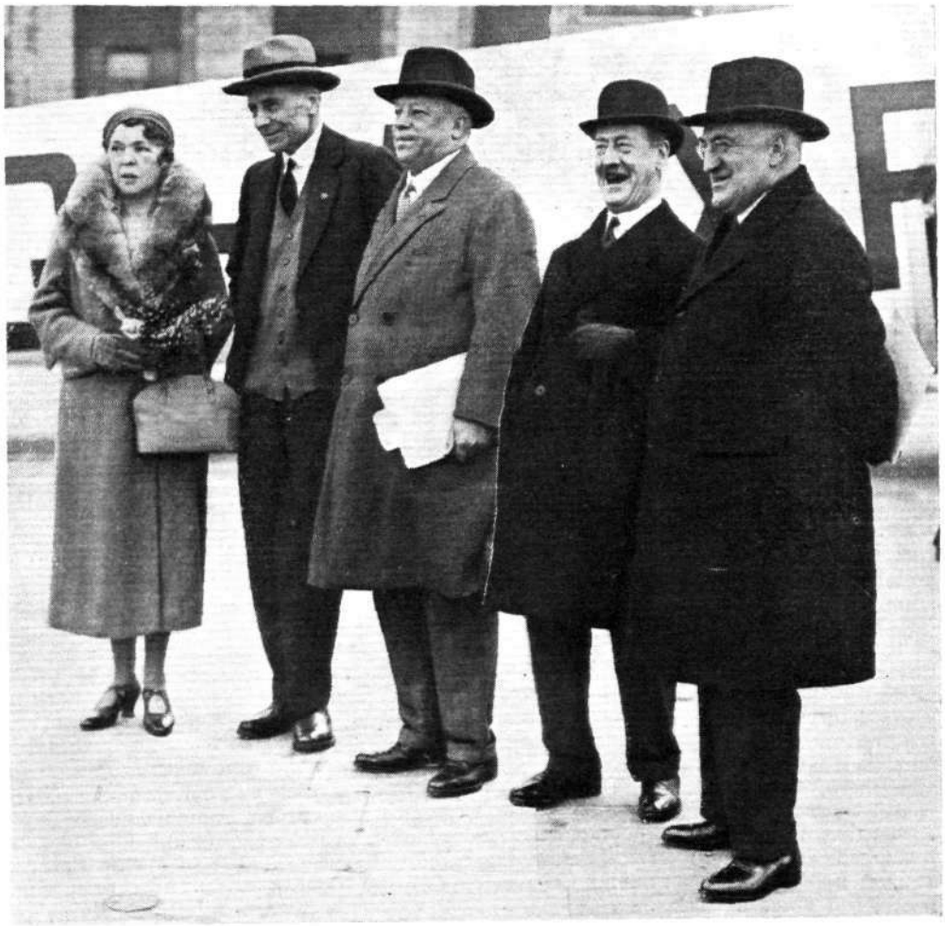
Readers interested in the subject would be well advised to obtain a copy of the booklet, which can be had on application to the Bureau of Information on Nickel, The Mond Nickel Co., Ltd., Imperial Chemical House, Millbank, London, S.W.1.

Air Transport

African Airway Opened

THE START FROM CROYDON

THE first air mail for Cape Town left Croydon at 12.30 p.m. on Wednesday, January 20, when the Handley Page 42, *Helena*, left the aerodrome for Paris carrying some 20,000 letters and 150 parcels, as well as three official passengers, namely, Mr. Bertram, Assistant Director of Civil Aviation; Air Vice-Marshal Sir Vyell Vyvyan, a Director of Imperial Airways; and Lady Vyvyan. The commander of the machine was Mr. A. B. H. Youell. For the first time in the history of British civil flying, a large plaque inscribed "Royal Mail," with the Royal initials in gold letters below, was affixed to the side of the aeroplane. A number of ordinary passengers for Paris also embarked on the machine, and seemed much impressed by the ceremony which attended the start, and evidently were very pleased to find themselves on board such an important aeroplane. As a matter of fact, the part played by *Helena* in the opening of the African airway was confined to a normal flight to Paris. There the mails and the three passengers went on by train to Brindisi, and the really exciting part of the flight only began at that seaport, when they embarked on a "Kent" flying boat for Athens and Alexandria. The African airway is concerned with the cargo to be carried through, not with any spectacular flight by any one machine or any one type of machine. As was pointed out in some detail in our last issue, no less than five types are being used by Imperial Airways on each journey to Cape Town. For the stages which each type will cover, we would refer our readers to the map which we published on page 74 of our issue last week.



BEFORE THE START: From left to right:—Lady Vyvyan, Maj. Ewart Grogan, D.S.O. ("The neolithic survival of a bygone age"), Air Vice-Marshal Sir Vyell Vyvyan, K.C.B, D.S.O., Lieut.-Col. Barrett-Lennard, C.B.E., and Lieut.-Col. Sir George Beharrell, D.S.O. (FLIGHT *Photo.*)

Imperial Airways are specialists in working out the details, technical and economic, of a great and novel undertaking. They are also quick to see and mark the historic importance of an occasion like that of last Wednesday week. They had invited a number of important and interesting personalities to be present at the start, and afterwards entertained them to a most recherché lunch at the aerodrome hotel. Lieut. Col. Sir George Beharrell, D.S.O., received the guests and presided at the lunch, while other directors present were Lieut. Col. J. Barrett-Lennard, C.B.E., and Mr. H. Scott Paine. All the arrangements were made with that thoughtful attention to detail which makes Imperial Airways so popular with their passengers and their guests. Large motor omnibuses met the party at Airways Terminus at Victoria Station, and conveyed them to Croydon aerodrome in something not very far short of record time. The lunch was a credit to the hosts and to the hotel management alike, the speeches were considerably above the average merit of after-lunch oratory on such occasions, and the wine list and the menu put into practice, so far as was possible, the war-cry "Buy British." The soup was made from Ascension turtle (someone asked what course would be dedicated to the Forced Landing); there was Cape crayfish, African citrus salad, New Jersey potatoes (perhaps "Jersey new potatoes" might have made matters clearer), Afrikaans fruit ice (we gathered that the ice was not brought direct from the Union in cold storage), and Kenya coffee.

Perhaps the happiest touch of the day was the presence of Maj. Ewart Grogan, D.S.O., the first man who ever walked from South Africa to Cairo. The present writer remembers well reading his book, "Africa from South to North," with intense interest about the year 1901, and was struck by a remark of an experienced sportsman: "He ought not to have put in that passage about the wounded buck; but then he's so young." At Croydon I set eyes on this interesting man for the first time, and the first remark which I heard him make was: "I am a neolithic survival of a bygone age." Thus does time work its revenges. Maj. Grogan and some other privileged persons were given a flight in *Hengist*, which escorted *Helena* out of Croydon, and I was told that Maj. Grogan would fly to Cape Town in the next machine to go. The Royal mail-plane was followed by Mr. Roy Tuckett in a "Puss Moth," with a kinematographer on board, so as to secure a film record of this first mail flight to Cape Town.

We should like to be able to say that *Helena* took off punctually on the stroke of 12.30, and we should probably have done so (regardless of where we might go when we

die) had not our photographer tactlessly included the aerodrome clock in his picture, and so given away the fact that *Helena* was four minutes late in leaving the tarmac. Youell made up some of this at once, for he lifted the great aeroplane off the ground after the shortest of runs—a friend who had great faith in his watch said that the run took just eight seconds—and doubtless the balance may be caught up in the course of the next 11 days, unless the train from Paris to Brindisi runs very late. Before our lunch was over, the news came through that *Helena* had arrived safely at Le Bourget. We hoped that Lady Vyvyan enjoyed her lunch as much as we enjoyed ours.

After the lunch had been duly discussed, and the Loyal Toast honoured, Col. Barrett-Lennard rose to propose "Empire Air Communications." He made an eloquent and humorous speech, mentioning the difficulties which Imperial Airways had had to encounter, difficulties political, economical, and of Dame Nature. The African airway was, he said, the first complete Empire air service; that was to say, it got to Cape Town and it could not go any farther. It was the work of a national company, with all the shares held by British subjects, with a working capital of not more than £500,000. He mentioned with regret that the shareholders had received dividends of under 3 per cent. As for the subsidies, all that he would say about them was that they were very small. The company's mileage figures were now becoming almost astronomical. They were flying 5,000 miles to India and 8,000 miles to South Africa each way every week. Multiply those figures by 52! This African airway was a great feat of organisation. It covered countries of most diverse character, ranging from low-lying desert to mountains 8,000 feet high. The station of M'beya, for instance, was 250 miles from any sort of a railway. Yet 11,000 gallons of petrol had been stored there, as well as other supplies, and nearly all had been brought from the railway on the heads of native porters. This had been the work of the local Government and of the petrol companies. As he had thanked the Air Ministry for the help which it had given, so he thanked the other parties, too. Wonderful work had been done. Twenty-four aerodromes and 42 landing grounds had been laid out. The mail from India had increased ten times since the opening of their service there, and he believed that the South African traffic would be still better. Imperial Airways had ordered eight Armstrong Whitworth monoplanes ("Atalantas"), which he hoped would be in service before the end of the year, and he hoped that before long the service to Cape Town would run twice a week.

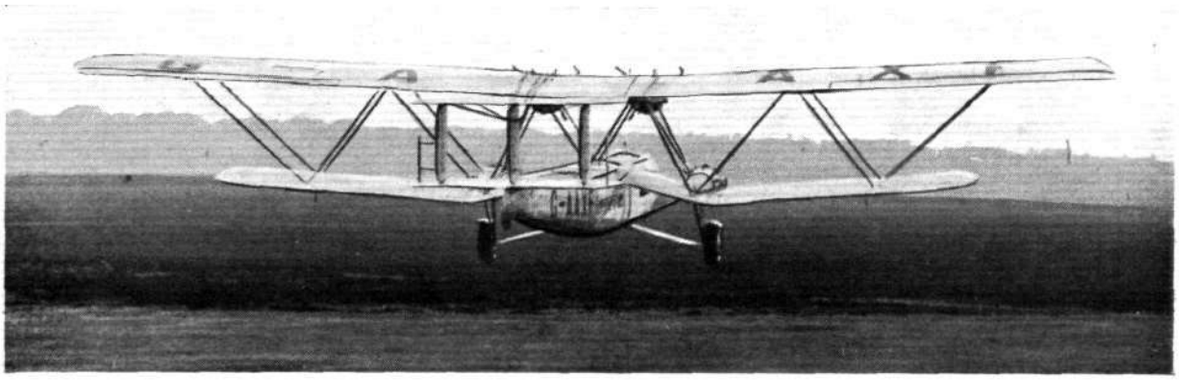
Three gentlemen spoke in response to this speech, Mr. G. W. Klerck, secretary to the office of the High Commissioner of South Africa, Mr. Wright, of the office of the High Commissioner of Southern Rhodesia, and Brig. Gen. Sir S. H. Wilson, Permanent Under-Secretary for the Colonies. Mr. Klerck told stories of the early days of communications in South Africa. Early mariners rounding the Cape used to leave letters under large stones with inscriptions asking the next passing ship to take them back to England. He also told of the Boer farmer who saw an aeroplane for the first time when one landed on his farm, and approached the pilot saying politely "Good day, God, my name is Van der So-and-So." The Union Government had done a great deal for this new service, having provided landing grounds and wireless and meteorological services. He believed that good wishes first came to man from the sky, and he hoped that more good would come from the sky through this new air service.

Mr. Wright spoke of the benefit which the airway would bring to Southern Rhodesia, a country which buys 76 per cent. of its goods from the Empire. They had been 21 days away from England; they were now only 10 days distant.

Gen. Wilson said that the Colonial Office had to deal with 55 Governments, and the air mail would help official despatches. It used to take 24 days to send a despatch to Nairobi, and now it would get there in a week.

Then Maj. Grogan, the first man to walk from South Africa to Cairo, rose to propose the toast of Imperial Airways. He began by describing himself as "a neolithic survival of a bygone age." Now a Little Bit of Fluff could buy a new lipstick, cast down her typewriter, seize an aeroplane, and flutter like a butterfly across the world. But if he was neolithic, there had been a palæolithic age. Sturdy old whiskered Dutchmen had explored Africa as far north as Tanganyika. The roads in Tanganyika and Kenya had been originally aligned by the wagons of Dutch pioneers. Then came a new age of pioneers, those of the air, and he mentioned in particular Lord Carberry, the late Lady Carberry, Sir Pierre Mostyn, Mrs. Wilson, and his old school-mate Freddy Guest. But the pioneering age had now gone, both by land and in the air. To fly across Africa was now not an adventure but an entrancing experience—while eight thousand miles of film of Empire was unrolled under your armchair.

Sir George Beharrell, in reply, said that the North-South airway would, he hoped, become a trunk line with feeders going out on either side. They intended to live up to their title of "Imperial Airways," and it would not be a long cry until they got to Australia. He also spoke of the possibility of flying to Canada. F. A. DE V. R.



OFF FOR CAPE TOWN! (FLIGHT *Photo.*)

A MAIL PLANE ORDERED

FROM the fact that the Air Ministry has decided to place the order for a fast air mail plane with Boulton & Paul, Ltd., of Norwich, it has now become possible to give a few particulars of this machine. It will be recollected that the original specification called for a machine with a cruising speed of 150 m.p.h., a range of 1,000 miles non-stop, and an air mail load (exclusive of crew, fuel, etc.) of 1,000 lb.

We believe we are correct in saying that the decision to select from among all the designs submitted the Boulton & Paul machine was made quite a long time ago, but there has, apparently, been some difficulty in persuading the Treasury that it would be false economy to abandon the building of the machine. Apparently the Treasury has now relented, and the machine is to be built at once.

The Boulton & Paul mail plane will resemble somewhat the same firm's "Sidestrand" day bomber, but will, of course, differ from it in many respects, quite apart from the difference in internal layout. That the stipulated performance will be attained, those best able to judge have no doubt. "On paper," the machine would, when fitted with fully supercharged Bristol "Jupiter" engines, have a top speed of more than 200 m.p.h. It has, however, been decided that medium supercharged "Jupiters" are

to be used, and this will reduce the speed slightly, although even with them the top speed should be within a few miles of 200 m.p.h., while the stipulated cruising speed of 150 m.p.h. should not be difficult to achieve.

The machine will have ample space for mails, and in addition to the normal straightforward arrangements for loading and unloading mails, provision will be made for dropping and picking up mail bags while the machine is flying.

At the moment it is not certain whether these modern adjuncts to rapid air mails will be required, but they will be available.

Air Mail Traffic

THE Postmaster-General announces that the development of the Letter Air Mail Service during the year 1931 was the most striking that has occurred since the service was established. During the year about 2¼ million letters were despatched by air, the increase over 1930 being about half a million letters, or approximately 10,000 letters a week. The total weight of the letter mail sent by air was 52.4 tons; this represents an increase of 29 per cent. over 1930 and no less than 74 per cent. over 1929. As will be seen below, this is only due in a small degree to the establishment of new services; the greater part of it is due to the greatly increased use made by the public of the normal air mails. The Christmas mail despatched to India by air during December last was well over 2 tons; the mail of December 12 alone weighed nearly a ton, which is the highest figure ever attained for a single flight by any air service from this country. The traffic to the various destinations was as follows:—

	1929	1930	1931
	lb.	lb.	lb.
Indian air service (including Egypt, Iraq, Palestine, etc.)	40,486	48,133	52,509
Central Africa service	—	—	5,457
Australian Internal Service ..	2,338	4,755	4,875
South African Internal Service	1,490	6,672	9,467
Other extra-European destinations	4,307	5,316	8,949
Continental Air Services ..	18,653	26,200	36,094
Total	67,274	91,076	117,351

The weight of air parcel mails despatched during 1931 was 62½ tons, or 10 tons more than the letter mail. This figure, however, was somewhat less than in 1930, although appreciably higher than the figures for 1929. The total weight of all air mail, letters and parcels for 1931 was 115 tons; this compares with 106 tons in 1930 and 88 tons in 1929.

Canada's Arctic Airways

WITHIN the past three years the aeroplane has established itself as a factor in the transportation business of the Far North, according to the North West Territories and Yukon Branch of the Department of the Interior. To-day well-equipped commercial airways companies operate in the Mackenzie and Keewatin Districts. The planes that pioneered the Arctic airways followed the well-established routes of river and coastal travel, but experience has now shown that much of the Arctic coastline is better served by cross-country routes. From Coronation Gulf West the several routes leading northward are based on Great Slave Lake. From this base three recognised routes are followed, one to Aklavik by way of the Mackenzie River; a second to Coppermine, via Rae, Great Bear Lake and the Valley of the Coppermine River; and a third from Reliance across country to the southern end of Bathurst inlet. The district of Keewatin is served from Winnipeg and The Pas, Manitoba, the route followed being the Nelson and Churchill Rivers and the western coastline of Hudson Bay.

A Ford Record

THE Ford air lines in operation in the United States set up a new record in the last month of the Old Year, completing the transport of 12,000,000 lb. of air freight. This record is believed to exceed the total freight carried by any other air transport service in the world. The services operate daily (Sundays excepted) between Ford Airport, Dearborn, Chicago and Cleveland. The Dearborn-Chicago service was the first to be brought into operation (April, 1925) and the system has since been considerably extended. The first air mail to be flown from Detroit was entrusted to Ford freight machines when in February, 1926, a daily service to Cleveland and Chicago was inaugurated. In achieving the record stated, the Ford Airline planes were in the air 19,236 hr. 40 min. and covered an aggregate of 1,778,715 miles—equal to more than 70 trips round the world.

A South African Merger

SUBJECT to ratification by the shareholders of the respective companies, negotiations for the amalgamation of the interests of South West Airways and Union Airways, the two aircraft operating companies in South Africa, have been brought to a successful conclusion.

Australian Xmas Air Mail at Melbourne

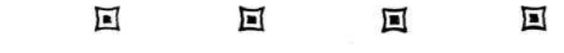
AIR COMMODORE KINGSFORD SMITH reached Melbourne in the Avro 10 *Southern Star*, with the Xmas mail from England, on January 22. He left Hamble on January 7, and reached Darwin on January 19; he arrived at Brisbane and Sydney on January 21 from Cloncurry—the longest one-day flight hitherto accomplished in Australia.

Belgian Air Services for 1931

THE following traffic figures have been issued regarding Belgian commercial air services during 1931:—Distance flown, 1,141,897 km. (710,000 miles); passengers carried, 7,721; freight (parcels and newspapers), 308,963 kg. (690,000 lb.). The figures for 1930 were 1,015,703 km. (630,000 miles), 7,296 and 214,083 kg. (470,000 lb.) respectively.

New Dornier Machines

THE Dornier Do.X 3, which has been constructed to the order of an Italian air traffic company, has been completed and will shortly undergo flying tests. The Do.K—which was described in FLIGHT for October 30 last—has been carrying out trial flights from the Templehof aerodrome recently.



R.Ae.S. Lecture

ON Thursday, February 4, 1932, Dr. Rudolf Benkendorff will read his paper on "The Organisation of Air Routes for Night Flying." The lecture will deal with the organisation for night flying in Germany from the first regular night air service for passengers, freight and mails from Berlin to Konigsberg in 1926 to date. Dr. Benkendorff considers the fundamental change which was introduced by blind flying and the network of direction finding stations which followed. He considers the types of beacons required, their positions, both lighted and wireless, along the routes and at the aerodromes. There are 1,085 miles of lighted airways in Germany with 97 principal beacons and 38 intermediate beacons in operation, and 14 ground direction finding stations. From the wide experience of the use of these night flying routes Dr. Benkendorff puts forward suggestions for the future. The lecture will be delivered in the Lecture Hall of the Royal Society of Arts, 18, John Street, Adelphi, W.C.2, at 6.30 p.m.

Aircraft Investment Board Changes

IT is announced that the following directors have resigned from the board of Aircraft Investment Corporation:—Mr. Andrew Holt (chairman), Capt. H. P. Holt, M.C., Mr. I. W. W. Shepherd, Mr. P. W. Pitt, Mr. H. C. Bevan. The secretary, Mr. J. J. Lovesay, has also resigned. Mr. George E. de Lengerke and Mr. G. G. H. Du Boulay have been elected directors.

Death of Sir Alfred Yarrow

WE regret to announce the death, on January 24, at the age of 90, of Sir Alfred Yarrow, the well-known shipbuilder. Only last November Sir Alfred completed a 3,000-mile air tour of Europe in an Imperial Airways machine.

Airisms from the Four Winds

Record Flight from Indo-China

ALTHOUGH they failed to establish any important record on their outward flight from France to Indo-China, the two French airmen, Codos and Robida, have succeeded in breaking all previous records on their return. It will be remembered they set out from Le Bourget on January 4 in a Breguet 330 (type 27) all-metal General Purpose biplane (650-h.p. Hispano Suiza), F-AKEZ, and reached Hanoi on January 11. Starting on the return flight on January 21, they arrived back at Le Bourget on the afternoon of January 24, having flown the 6,900 miles in the record time of 3 days 5 hours 40 minutes, beating the previous record of 4 days 12 hours established by Costes and Bellonte. The flight was carried out in the following stages:—Hanoi to Calcutta, Calcutta to Karachi, Karachi to Basra, Basra to Athens, Athens to Rome, Rome to Marseilles, and Marseilles to Paris. To accomplish this flight the airmen have had to go "all out" with a vengeance, neither having had more than an hour's sleep throughout, while stops for refuelling were cut down to the lowest possible time. It should be mentioned here that Shell fuel and "Castrol" oil were used on this flight. As will be seen from the accompanying illustration of the machine actually used on this flight, the Breguet in question is similar to the famous "type 19," except for the peculiar fuselage, which is built up round a comparatively small cross-section box girder, the rear portion of which, carrying the tail surfaces, is seen extending from the nacelle-like "business" portion of the fuselage.

HANOI–LE BOURGET IN 3¼ DAYS: The Breguet 330 (650 h.p. Hispano Suiza) on which Codos and Robida have just accomplished a record flight from Hanoi to Le Bourget.

R.A.F. East African Flight

THE four Fairey III.F machines of No. 14 (Bomber) Squadron, R.A.F., which are carrying out a flight over East Africa under the command of Flt. Lt. R. L. Atcherley, reached Jinja, Uganda, from Entebbe on January 21, and Kisumu on January 24. They arrived at Nairobi on January 26, but plans for co-operation with the King's African Rifles have had to be considerably restricted as these troops are at present engaged in locust destruction in the Masai Reserve and Northern Frontier.

Italian Flight to Africa

SIG. LOMBARDI and DR. ROBBIANO left Rome on January 21 in a Caproni 105 touring aeroplane (200-h.p. Alfa-Romeo "Lynx") on a flight to Cape Town. They reached Wady Halfa early on January 22 and Malakal in the evening. After a stop of 4 hr. for refuelling they took off again for Mwanza.

Sir Philip Sassoon's Air Tour

SIR PHILIP SASSOON, Under-Secretary of State for Air, has completed his tour of the R.A.F. bases in the Near East, and returned to England from Karachi last week by way of Imperial Airways air mail service.

A Flight to Timbuctoo

WITH the object of interviewing a monk who is an authority on native languages, Miss Marjorie Worthington and Mr. William Seabrook, the African traveller, left Paris for Timbuctoo on January 21 in a machine piloted by Capt. René Wauthier. They reached Oran on January 23.

Nairobi-Germiston in Two Days

MR. M. C. P. MOSTERT—who early last year made a fine flight across Central Africa—and Mr. R. F. Green recently accomplished a fast flight from Nairobi to Germiston in a D.H. "Puss Moth." They left Nairobi at 4.30 a.m. on December 20 last and reached Broken Hill, 1,200 miles distant, 11½ hr. later. Proceeding at 5 a.m. next day they arrived at Germiston shortly after 2 p.m., a halt of 65 min. having been made at Bulawayo.

Gen. Lewin Flies Home

GEN. ARTHUR LEWIN, a farm owner of Kenya, aged 57, who recently obtained his pilot's certificate at Heston, arrived at Nairobi on January 27 from England in his "Gipsy Moth." He left Heston—accompanied by F/O. Stone as navigator—three weeks ago.

Eddie Stinson Killed

EDWARD A. STINSON, the well-known American pilot, was fatally injured on January 20 when his aeroplane crashed on a golf course at Chicago.

THE DOUGLAS 0-35: This new type observation plane of the U.S. Army Air Corps is the Douglas 0-35, powered with two Curtiss GIV-1570C 600 h.p. engines. This type is closely similar to the Douglas B-7 Bomber, both having a metal fuselage and carrying crews of three.

The Industry

MAKING AIRSCREWS

IN these days it is easy to allow the intrusion of metal construction in the aircraft industry to overshadow the extent to which wood is still employed. We recently visited the works of The Airscrew Co., Ltd., in Weybridge, Surrey, vaguely suspecting that the wooden type was having a stiff combat with the metal intruder. But, on being unemotionally informed that the output at Weybridge was between 80 and 100 per week, we had to admit our sense of proportion in the matter was rather awry. It is when one is made aware of the output figures of aircraft components that the industry begins to reveal its size. To impress the sceptic about the industry it would be a good notion to quote the output figures not of aircraft, but of the components! That would silence them.

During the entire process of manufacturing wooden airscrews the temperature of every department of the Weybridge factory is maintained near 65 deg. F. in order to keep the wood in an even condition. Honduras mahogany and American black walnut are the woods used, either separately or in combination, but black walnut being now very scarce, mahogany is therefore often used alone. One finds perhaps the outer laminations of an airscrew made of walnut, where its extreme hardness is suitable for bearing the coupling bolts on the engine hub. When both kinds of wood are used, the combination of the two make a pretty contrast in pattern. The walnut is heavier than the mahogany, and when it was plentiful, it was used more than the other.

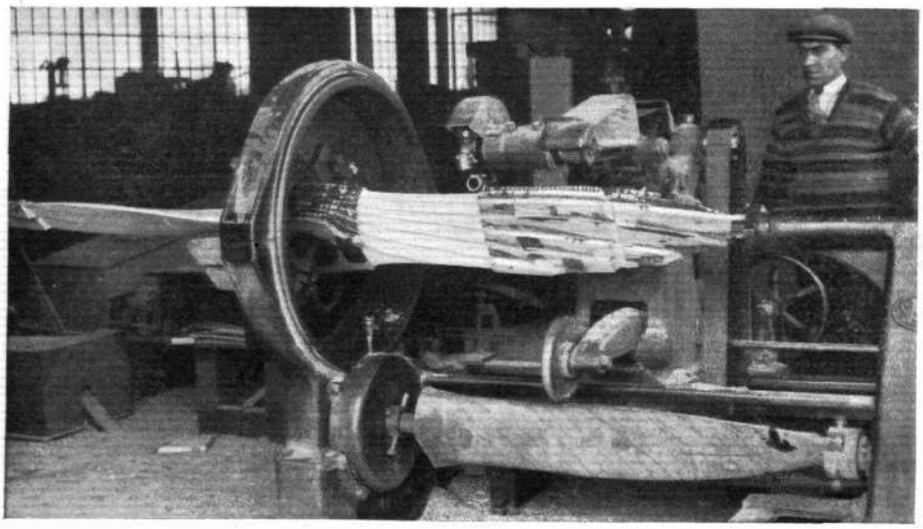
The preliminary tests applied to the woods before manufacture begins are an impact test of 4.5 ft. lb., and a moisture test, the maximum allowed being 14 per cent. of moisture. When each lamination is marked out on a plank, a piece about a foot long is also marked alongside on the surplus wood, and this piece is cut out for the impact test. Before the marking out is done, the selected plank is carefully inspected for defects. The timber must be of the finest and straightest grain, and to make certain of a constant supply which will fulfil the standard required it is necessary to stock thousands of feet of timber. Even after each lamination is cut out, it is stored for a period to determine any warping tendencies. The number of laminations in an airscrew depends, of course, upon the size of the airscrew, and before a set is built up, each has to pass a balance test, for if this test were left entirely to a later stage in the manufacture, a serious lack of balance could not be corrected.

Each lamination is bored in the centre and simply fitted on a horizontal shaft, and it is hardly necessary to take a reading for the result. Usually one side will be slightly heavier than the other, due to the difference in density along the wood, but a correction is easily obtained by turning the lamination round in its place amongst the other laminations before gluing, so that the heavy side will be opposite to—and counteract—the heavy side of the next one. The law of averages always enters to assist in achieving the balance required. Later on a perfect result can be attained in the shaping shop.

The Airscrew Co., Ltd., Glueing Shop at their Weybridge Works :—Sets of laminations are seen in the clamps, where they remain for forty-eight hours, and then pass on to the shaping machine for rough shaping.

Between the cutting-out stage and the glueing stage each lamination has been subjected to planing with a tooth-edged planing machine, which leaves the surfaces "toothed" to enable the glue to get a good grip. The glue used is a Casein glue powder, mixed with water in a mixing machine, which consists primarily of two vertical sets of prongs revolving in opposite directions. For forty-eight hours the set of laminations is left between the jaws of numerous clamps, oozing glue under constant pressure, and then follows rough shaping on the belt-driven Sagar shaping machine or lathe. As the rough airscrew slowly revolves in the lathe drum, the swiftly-revolving cutter makes a steady horizontal journey from one side of the rough boss to a point along the blade about 5 in. from the tip, shaping the laminations to the pattern of a cast-iron blade or frame revolving at the same speed below. It is not economical for the company to cast these frames unless an order for airscrews is 25 or more, or, if actually less, there must be the probability of a repeat order. When the airscrew comes off the shaping lathe, it has a familiar appearance for the first time. The blades have taken shape, though the cutter has left noticeable corrugations in the surfaces. These, however, are quickly smoothed out when the craftsmen get to work. Five days at least elapse before the airscrew reaches the shaping shop after leaving the lathe, and then the propeller shapers, as the craftsmen are called, start the final shaping on the 6 m/m. of thickness left them. At the tip they have but 2 m/m. in hand. Each blade is marked in pencil at sections towards the tip, as places for the shapers to apply their gauges during shaping, a constant check for widths, thicknesses and pitch angles being necessary. On the pitch an allowance of plus or minus 15 min. is permitted. The shapers level to the airscrew boss—which lays flat on the bench—with their gauges and spirit level. After hand-shaping the bolt holes are bored, a clearance of 2 m/m. on the holes

The Shaping Shop at Weybridge :—Here the airscrews receive the final shaping by hand after rough shaping on the lathe. Sometimes the larger airscrews are shaped entirely by hand.



Shaping Machine:—A set of laminations receiving rough shaping in the lathe, the pattern being determined by the cast frame seen revolving below.

being allowed. On the centre bore the allowance is 0·5 m/m.

Next comes what is picturesquely called "inspection in the white," and the final balance is taken with taper bushes in the bore. Large airscrews are balanced on ball races, and small types on knife edges. If perfect balance is not registered now, the airscrew goes back to the hand shaper for another delicate touch. After checking up with protractors and gauges, the inspection department pass on the airscrew to the finishing shops, where fabric is glued on and ironed, to even it over the blade. Varnish is then applied. There are several different finishing processes. The airscrew can be fabriced and varnished as described, or painted and varnished, or treated with cellulose. All the blade tips and leading edges are sheathed with 24-gauge brass sheeting, screwed with countersunk heads at the edges, and riveted at the tips, all the heads being sweated with solder. This concludes the process of manufacture. There remains to be mentioned that the large four-bladed airscrews are sometimes shaped entirely by hand, and that amongst the largest types produced at Weybridge were the 16 ft. dia. (19 in. dia. boss) airscrews for the deceased R.101. During our interesting visit the shaping of four-bladed airscrews destined for the Handley Page "Hannibal" type of aircraft were in progress.

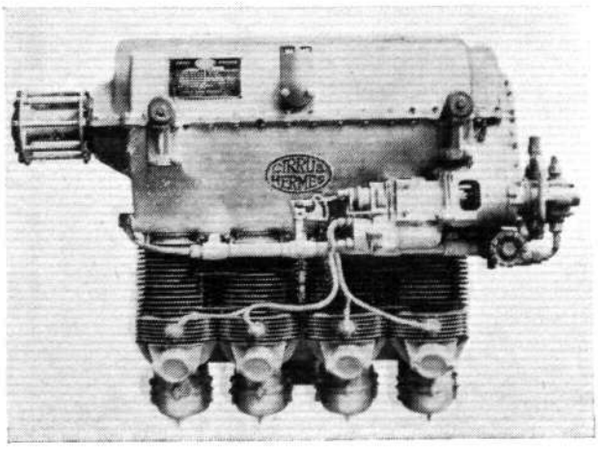
As for the life of a wooden airscrew, one was modestly informed of a Weybridge airscrew completing 500 flying hours in the service of Imperial Airways and going back to another 500 hours after reconditioning, while other records in the possession of Mr. J. D. Titler, Managing Director, Airscrew Co., Ltd., refer to working lives of up to 3,000 flying hours.

BRITISH INDUSTRIES FAIR

AERIAL travel concessions for those attending the Fair include a 25 per cent. reduction by Imperial Airways on return fares from the Continent and also from Athens, Alexandria, Cairo, Khartoum, Baghdad, Basra, Karachi, and Kasuma. The Sabena Line also offers a 25 per cent. reduction, while the Luft Hansa and K.L.M. offer 10 per cent. reductions. Free passport visas, valid for three months, have been granted by the Foreign Office for visitors to the Fair.

THE KLEMM-POBJOY

IN VIEW of the exceptional characteristics of this Klemm, making it particularly suitable for private ownership, Mr. A. B. Gibbons, whose family business is James Gibbons, Ltd., together with a partner in the person of Mr. B. R. Hannen of Holland, Hannen, and Cubitts is forming a company for developing the manufacture of these machines in Great Britain. They have arrived at terms with the Leichtflugzeugbau-Klemm G.m.b.H. for the licence and manufacture under their patents, and to sell British Klemms throughout the Empire except in Canada. They expect to complete these arrangements shortly. It is understood that the new company will take the form of a finance and sales company and will be linked to one of our British aircraft manufacturing firms by interchange of shares and directors. Several manufacturers have been invited to submit schemes for production, costing, finance and control. Meanwhile it is intended that the Klemm policy should be used to demonstrate to the manufacturing and financial interests the possibility of this new venture. The company propose to concentrate on the Pobjoy engine as the most suitable power unit.



105-115 h.p. Cirrus-Hermes Mk.II B Engine. Fitted with enclosed valve gear and resilient bearer feet. Finished in black lacquer, as standard.

"SWIFT'S" ABROAD

IMMEDIATELY the little Comper "Swift" was placed on the market, it was found that it filled a want for those flying in out-of-the-way parts of the Empire, so much so that the firm was almost inundated with orders. Amongst the places abroad to which "Swifts" have already been sent are Canada, Tanganyika, New Zealand, Australia, India, South America and the Irish Free State. As the "Swift" was only put into production at the end of last July, this response would seem highly creditable.

ETHYL NOW CHEAPER

WE are notified by the Anglo-American Oil Company that Pratts Ethyl petrol, always hitherto marketed at a premium, is now reduced to the same price as regular petrols, the new price being operative as from Saturday, January 23. Arrangements are rapidly being completed for making Ethyl available at all points throughout the country. Pratts Ethyl petrol was used in the Schneider Trophy Contest.

HERMES RELIABILITY

AN interesting report has come to hand from New Zealand which amply demonstrates the exceptional reliability obtainable from the Hermes engine. Sqd. Ldr. M'Gregor, who recently carried mails from Invercargill and Auckland in one day, landing *en route* at Dunedin, Christchurch, Blenheim, Wellington, Palmerston North and New Plymouth, says that the engine and the Spartan aircraft to which it was fitted behaved in an exemplary manner throughout on that strenuous trip. He left at 3.56 a.m. and arrived at 5.56 p.m., which was some two hours under his scheduled time, over a distance of approximately 900 miles. The following day he carried mails back again from Auckland to Wellington in order to catch the Sydney boat, and once more had no trouble at all with either the engine or aircraft.

THE ROYAL AIR FORCE

London Gazette, January 19, 1932

General Duties Branch

Flight Cadet C. J. Giles, having successfully passed through R.A.F. College, Cranwell, is granted a permanent commn. as Pilot Officer on probation, with effect from December 19, 1931, and with seny. of June 18, 1931. The follg. flight cadets, having successfully passed through the R.A.F. College, Cranwell, are granted permanent commns. as Pilot Officers with effect from and with seny. of Dec. 19, 1931 :—A. Pyke, R. H. E. Emson, R. Monks, G. H. O. Mills, J. T. Longman, E. F. Porter, F. H. Tyson, D. E. Forman, L. N. Elsner, T. A. B. Parselle, M. F. D. Williams, N. G. Goodman, D. V. Johnson, M. B. Hamilton, A. W. Geoghegan, E. A. Collyns, H. P. Jenkins, J. Worrall, A. M. Doran, D. McD. Fenton, W. P. Sutcliffe, P. S. Gomez, R. H. A. Leigh, J. N. H. Whitworth, H. D. Raynham, G. W. Montagu, D. Prowse, R. E. Barnett, S. P. Langston, A. R. Glencross.

The follg. are granted permanent commns. as Pilot Officers with effect from Jan. 11, and with seny. of dates stated :—E. R. Pearce (Oct. 23, 1930) ; R. G. Shaw (Flying Officer, R.A.F.O.) (Jan. 11, 1931) ; G. E. Valentine (July 11, 1930). Pilot Officer G. W. P. Grant is promoted to rank of Flying Officer (Dec. 27, 1931).

The follg. Flying Officers are promoted to rank of Flight Lieut. (Jan. 18) :—W. Gill, C. H. V. Hayman, F. Simpson, W. Wheatley.

Squadron Leader J. C. Slessor, M.C., is granted acting rank of Wing Commander (unpaid), while seconded for duty as Instructor at the Staff College, Camberley (Jan. 1) ; Air Vice-Marshal F. R. Scarlett, C.B , D.S.O., is placed on retired list at his own request (Dec. 31, 1931) (substituted for *Gazette* Jan. 5); Squadron Leader E. D. Atkinson, D.F.C., A.F.C., is placed on retired list on account of ill-health (Jan. 18). The follg. are placed on retired list (Jan. 18) :—Flight Lieut. W. R. Heywood, Flying Officer R. J. E. Haynes, Flying Officer A. H. Berry, D.S.M.

Pilot Officer on probation F. R. Dix resigns his short service commn. (Jan. 20). The short service commns. of the follg. Pilot Officers on probation are terminated on cessation of duty :—H. Bottomley (Jan. 18) ; J. G. de V. Hunt, L. M. B. Vickers (Jan. 20).

Stores Branch

The follg. are granted permanent commns. as Pilot Officers on probation with effect from and with seny. of Jan. 8, 1931 :—C. F. Harrington, K. N. Smith, A. R. Morton, J. H. Barnes, E. G. Ambridge, S. W. Meedham.

Dental Branch

P. J. C. Keane, L.D.S., is granted a non-permanent commn. as Flying Officer with effect from and with seny. of Jan. 4.

ROYAL AIR FORCE RESERVE
RESERVE OF AIR FORCE OFFICERS

General Duties Branch

Flying Officer L. A. Parker is granted the honorary rank of Flight Lieut. (Jan. 20) ; Flying Officer R. G. Shaw relinquishes his commn. on appointment to a permanent commn. in R.A.F. (Jan. 11).

Special Reserve

Flying Officer N. D. Wardrop is removed from the Service (Jan. 20).

AUXILIARY AIR FORCE

General Duties Branch

No. 604 County of Middlesex (Bomber) Squadron.—R. L. Nimmo is granted a commn. as a Pilot Officer (Dec. 8, 1931).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified :—

General Duties Branch

Group Captain R. H. Peck, O.B.E., to No. 3 Flying Training School, Grantham, pending taking over command, 11.1.32.

Wing Commanders : E. B. Beauman, to R.A.F. Staff College, Andover, for duty as Instructor, 11.1.32. D. G. Donald, D.F.C., A.F.C., to No. 1 (Indian Wing) Station, Kohat, pending taking over command, 5.1.32.

Squadron Leaders : H. W. L. Saunders, M.C., D.F.C., M.M., to No. 45 Sqdn., Helwan, Egypt, 8.1.32. W. E. Theak, to H.Q., R.A.F., Mediterranean, Malta, 8.1.32. C. Findlay, D.F.C., to R.A.F. Training Base, Leuchars, 24.12.31.

Squadron Leaders : S. E. Toomer, D.F.C., to No. 2 Sqdn., Manston, 18.12.31. A. R. Mackenzie, to H.Q., Inland Area, Stanmore, 28.12.31. A. L. Paxton, D.F.C., to No. 23 Sqdn., Kenley, 28.12.31. C. Boumphrey, D.F.C., to No. 1 School of Tech. Training (Apprentices), Halton, 31.12.31. C. W. Mackey, to No. 21 Group H.Q., West Drayton, 19.12.31. A. C. Collier, to H.Q., Air Defence of Gt. Britain, Uxbridge, 19.12.31. C. E. V. Porter, to Royal Air Force College, Cranwell, 19.12.31. M. Thomas, D.F.C., A.F.C., to H.Q., R.A.F., India, New Delhi, 24.12.31. F. A. Norton, to Aircraft Depot, Karachi, India, 24.12.31. R. T. B. Houghton, A.F.C., to No. 11 Sqdn., Risalpur, India, 24.12.31. J. C. Slessor, M.C., to Special Duty List, whilst seconded for duty as R.A.F. Instructor at Staff College, Camberley, 1.1.32. L. G. S. Payne, M.C., A.F.C., to No. 1 Air Defence Group H.Q., 28.12.31. J. J. Breen, to H.Q., Wessex Bombing Area, Andover, 2.1.32. R. S. Aitken, M.C., A.F.C., to Air Ministry (D.O.S.D.), 4.1.32. M. F. Browne, to Station H.Q., Boscombe Down, 1.1.32. E. D. Davis, to Air Armament School, Eastchurch, 4.1.32. H. G. W. Lock, D.F.C., A.F.C., to Air Ministry (D.P.S.), 4.1.32. The Hon. R. A. Cochrane, A.F.C., to Air Ministry (D.O.I.), 8.1.32. A. P. M. Sanders, to R.A.F. Depot, Uxbridge, 1.1.32. W. B. Everton, to Home Aircraft Depot Henlow, 8.1.32. L. G. Maxton, A.F.C., to R.A.F. Base, Calshot, 4.1.32. J. O. Andrews, D.S.O., M.C., to No. 210 Sqdn., Pembroke Dock, 3.1.32 H. E. P. Wigglesworth, D.S.C., to H.Q., Air Defence of Gt. Britain, Uxbridge 1.1.32. G. W. Bentley, D.F.C , to School of Naval Co-operation, Lee-on-Solent, 5.1.32. G. F. Smylie, D.C.S., to No. 58 Sqdn., Worthy Down, 1.1.32.

Flight Lieutenants : H. J. Brown, to Home Aircraft Depot, Henlow, 4.1.32. E. H. Searle, to H.Q., R.A.F., Middle East, Cairo, 8.1.32. B. V. Reynolds, to R.A.F. Training Base, Leuchars, 8.1.32. J. M. Fairweather, D.F.C., to No. 3 (Indian) Wing H.Q., Quetta, 5.1.32. A. R. Wardle, A.F.C., to H.Q., R.A.F., India, New Delhi, 5.1.32. R. Menzies, to No. 28 Sqdn., Ambala, India, 15.12.31. J. R. Adams, A.F.C., to No. 31 Sqdn., Quetta, India, 5.1.32. J. Norwood, to No. 5 Flying training School, Sealand, 8.1.32.

Flight Lieutenants : H. M. S. Wright, to Aircraft Park, Lahore, India, 24.12.31. G. H. Huxham, to No. 1 (Indian) Group H.Q., Peshawar, 24.12.31. G. M. Heard, to No. 1 (Indian Wing) Station, Kohat, 24.12.31. G. H. Shaw, to Aircraft Depot, Karachi, India, 24.12.31. A. G. Thackray, to R.A.F. Depot, Uxbridge, 20.12.31. F. L. B. Hebbert, to No. 1 Air Defence Group H.Q., 19.12.31. P. L. Plant, to No. 13 Squadron, Netheravon, 19.12.31. G. G. Banting, to No. 56 Squadron, North Weald, 19.12.31. G. W. Birkinshaw, to No. 207 Squadron, Bircham Newton, 19.12.31. H. N. Hampton, D.F.C., and E. D. H. Davies, to H.Q., Coastal Area, 19.12.31. P. J. R. King, to H.Q., Iraq Command, Hinaidi, 14.12.31. I. M. Rodney, to No. 111 Sqdn., Hornchurch 19.12.31. T. C. Traill, D.F.C., to No. 12 Sqdn., Andover, 8.1.32. J. W. Baker, M.C., D.F.C., to Air Ministry (D.O.S.D.), 1.1.32. G. L. Ormerod, to Air Armament School, Eastchurch, 1.1.32. C. H. Flinn, to No. 1 Air Defence Group H.Q., 7.1.32. N. H. D'Aeth, to No. 101 Sqdn., Andover, 3.1.32.

Flying Officers : P. Haynes, t No. 20 Sqdn., Peshawar, India, 5.1.32. I. G. Llewellyn, to R.A.F. Base, Gosport, 1.1.32. C. D. C. Boyce, to R.A.F. Depot, Uxbridge, 1.12.31. H. G. Adams, to No. 208 Sqdn., Helopolis, Egypt, 8.1.32. F. B. H. Hayward, to No. 23 Sqdn., Kenley, 4.1.32. H. L. Piper, to No. 503 Sqdn., Lincoln, 6.1.32. L. H. Snelling, to No. 504 Sqdn., Nottingham, 5.1.32. J. C. Harcombe, to No. 3 Flying Training School, Grantham, 11.1.32. G. O. St. J. Morris, to No. 607 Sqdn., Durham, 5.1.32.

Flying Officers : J. B. Knapp, to R.A.F. Depot, Uxbridge, 6.1.32. R. C. Field, to No. 4 Sqdn., S. Farnborough, 24.12.31. A. G. C. Somerhough, to R.A.F. Depot, Uxbridge, 26.11.31. A. R. Combe, to No. 4 Flying Training School, Abu Sueir, Egypt, 15.12.31. R. J. Cooper, to No. 14 Sqdn., Amman, Palestine, 17.12.31. G. H. W. Selby-Lowndes, to No. 12 Sqdn., Andover, 3.1.32. D. A. Cameron, to R.A.F. Base, Gosport, 31.12.31. N. Foster-Packer, to R.A.F. Depot, Uxbridge, 21.11.31. B. T. Crook, to R.A.F. Depot, Uxbridge, 19.11.31. G. E. Klein, to No. 10 Sqdn., Boscombe Down, 4.1.32. A. P. F. M. Berkeley, to Home Aircraft Depot, Henlow, 3.1.32.

Pilot Officers : S. C. Widdows, to No. 29 Sqdn., North Weald, 14.12.31., J. D. Best, R. C. M. Collard, W. J. Cox, F. W. Dixon-Wright, P. I. Harris, W. P. Harvey, E. V. Knowles, T. F. U. Lang, H. B. Leggatt, G. R. Murphy, R. S. Ryan, W. S. P. Simonds, A. W. Sweeney, J. R. Talbot, A. J. Warford-Mein, A. P. S. Wills, G. P. Woodhouse, P. E. Woollcombe-Adams, all posted to R.A.F. Depot, Uxbridge, on appointment to short service commns. with effect from 29.12.31. R. T. Cazalet, to R.A.F. Base, Gosport, 3.1.32. H. L. M. Glover, to No. 18 Sqdn., Upper Heyford, 4.1.32.

Pilot Officers : G. J. S. Chatterton, to R.A.F. Depot, Uxbridge, 2.11.31. R. B. Dashper and C. E. Littler, to No. 208 Sqdn., Helopolis, Egypt, 8.1.32. G. V. Barber, to R.A.F. Depot, Aboukir, Egypt, 8.1.32. T. Q. Horner, to No. 202 Sqdn., Malta, 8.1.32. M. W. L'I. La V. Baker and H. P. Broad, to No. 31 Sqdn., Quetta, India, 5.1.32. A. H. Button, to No. 3 Flying Training School, Grantham, 1.1.32.

The following Pilot Officers are posted as stated on appointment to permanent commn. from the R.A.F. College, with effect from 19.12.31 :—J. Worrall, to No. 1 Sqdn., Tangmere ; S. P. Langston, to No. 2 Sqdn., Manston ; M. B. Hamilton, to No. 3 Sqdn., Upavon ; G. H. O. Mills, to No. 13 Sqdn., Netheravon ; E. F. Porter and A. Pyke, to No. 16 Sqdn., Old Sarum ; P. S. Gomez, to No. 17 Sqdn., Upavon ; A. M. Doran, L. N. Elsner and R. H. E. Emson, to No. 18 Sqdn., Upper Heyford ; R. Monks, to No. 25 Sqdn., Hawkinge ; D. V. Johnson, and F. H. Tyson, to No. 29 Sqdn., North Weald ; C. J. Giles, to No. 33 Sqdn., Bicester ; H. P. Jenkins and J. T. Longman, to No. 35 Sqdn., Bircham Newton ; G. W. Montagu, to No. 40 Sqdn., Upper Heyford ; R. E. Barnett, to No. 54 Sqdn., Hornchurch ; E. A. Collyns, R. H. A. Leigh and T. A. B. Parselle, to No. 57 Sqdn., Netheravon ; A. W. Geoghegan, H. D. Raynham and J. N. H. Whitworth, to No. 99 Sqdn., Upper Heyford ; D. E. Forman and N. G. Goodman, to No. 100 Sqdn., Donibristle ; D. McD. Fenton and A. R. Glencross, to No. 101 Sqdn., Andover ; D. Prowse, to No. 111 Sqdn., Hornchurch ; W. P. Sutcliffe and M. F. D. Williams, to No. 207 Sqdn., Bircham Newton.

Stores Branch

Wing Commander J. A. Stone, to R.A.F. Depot, Aboukir, Egypt, for Stores Staff Duties, 8.1.32.

Flight Lieutenant F. A. Skoulding, to H.Q., R.A.F., India, New Delhi, 5.1.32.

Accountant Branch

Flight Lieutenants : F. H. Wakeford, to R.A.F. Base, Malta, 8.1.32. F. C. Chalmers, to H.Q., R.A.F., Middle East, Cairo, 8.1.32.

Flying Officers : J. Lambie, to No. 4 Flying Training School, Abu Sueir, Egypt, 8.1.32. J. E. Gregson, to No. 6 Sqdn., Ismailia, Egypt, 8.1.32.

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R.A.F. SPORT

RUGBY

R.A.F. v. Cambridge University

The Royal Air Force beat Cambridge at Cambridge on Wednesday, January 20, by three goals (one penalty) and a try (16 points) to a try (3 points). The game was a poor one, the University only playing three Blues. L.A.C. Williams at fly-half was the most successful player on the field, and F/O. Coote at right centre and Flt. Lt. G. Beamish and Cpl. Christie among the forwards played well for the R.A.F. Cambridge scored in the first half. After half-time the Air Force gained tries through G. Beamish (2) and Coote. Williams converted two tries and kicked a penalty goal. The R.A.F. team was :—F/O. G. M. Ievers (58 B.S.) ; P/O. Walker (Mt. Batten), F/O. P. B. Coote (43 F.S.), P/O. J. R. Talbot (2 F.T.S.), and P/O. G. A. L. Manton (2 F.T.S.) ; L. U/C S. Williams (Boscombe Down) and F/O. R. M. Nobeston (9 B.S.) ; F/O. P. J. C. Keane (Henlow), P/O. B. E. Valentine (2 F.T.S.), F/O. C. Beamish (Uxbridge), P/O. A. L. Holland (Grantham), Flt. Lt. G. R. Beamish (Henlow), Cpl. M. G. Christie (503 B.S.), Sgt. Lewis (Mt. Batten), and Flt. Lt. B. V. Reynolds (Netheravon).

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AIRCRAFT COMPANIES' STOCKS AND SHARES

FOR the greater part of the month leading industrial shares moved in favour of holders on the possibility of a satisfactory settlement of the reparations problem in the near future. Subsequently prices lost some of their improvement on fears that the matter may be deferred for six months, but later they were in some cases marked up on the prospect of a general tariff of 10 per cent. or 15 per cent. being introduced early in the new session of Parliament. Generally speaking, public interest in the stock and share markets remains at a low ebb. It will apparently require a development of importance in the home or foreign situation to improve the position in this respect.

Among the shares of aircraft and allied companies, Fairey Aviation have again been an outstanding feature, firstly on the very favourable impression created by the chairman's speech and secondly on the further £300,000 contract received from the Belgian Government. On balance for the month there has been a rise from 14s. 9d. to 15s. 4½d., and at one time 15s. 6d. was touched. The debentures, which have also attracted attention, were at one time up to 107½ following business at 106. A point the market believes augurs well for the future is the chairman's disclosure that in consequence of continuity of output and increased turnover, it has been possible to work on a lower basis of charges and make reductions in prices. Although little business has been marked in D. Napier & Son's ordinary, which have lost 9d. on the month, they attracted a good deal of attention. It will be recalled that in September last the interim dividend was passed. The market is not inclined to forecast the final dividend, but would apparently not be surprised if it were 7½ per cent. For the previous year the total dividend was 15 per cent. Even on a 7½ per cent. basis the yield would be satisfactory at the present price. As the company is fortunate in having a good financial position, it is being argued that the shares have attractions for an investor prepared if necessary to hold for a period. Interest in Handley Page preference has fallen off and the price is 9d. lower on the month. Aided by favourable traffics and the opening of the Cape route, Imperial Airways have been maintained and give the appearance of a steady market. Rolls-Royce have come in for support and have gained 1s. 3d. to 30s. since these notes last appeared. It is being suggested that the company's increasing interest in aero engine manufacture may do much towards off-setting lower profits from its main business. In any case, the strong financial position would warrant drawing on reserves or carrying forward a smaller sum in order to maintain the dividend. Recovery has been shown by Ford Motor, aided by expectations that the dividend will be kept at 10 per cent. Vickers participated fully in the marking up of iron and steel shares on the prospect of a tariff forthcoming in the near future. Although the company remains chiefly interested in armament work, it has over the past few years followed the policy of increasing its operations in the industrial field. The report is due in March. For the previous year about 11¼ per cent. was earned on its ordinary shares, and the dividend was limited to 8 per cent. A good deal of interest has been shown in Triplex Safety Glass on the order that motor vehicles registered for the first time this year have to be fitted with safety glass. Joseph Lucas have again moved against holders, but this is due more to absence of support than any pronounced selling. Brown Brothers, which are held tightly and are not a particularly free market, have remained at 22s. 6d. The report can be expected by March. As about 17 per cent. was earned on the ordinary shares for the previous year, there would apparently have to be a heavy fall in the past year's profit for the dividend not to be maintained at 10 per cent. Dunlop Rubber moved against holders owing, it is currently stated, to liquidation of a large parcel of shares from a deceased estate. Oil shares participated in the better market tendency during the month and are materially higher on balance.

Name.	Class.	Nominal Amount of Share.	Last Annual Dividend. %	Current Week's Quotation.
Anglo-American Oil	Deb.	Stk.	5¼	97½
Armstrong Siddeley Develop	Cum. Pref.	£1	6½	11/3
Birmingham Aluminium Castg.	Ord.	£1	5	18/6
Booth (James), 1915	Ord.	£1	15	38/-
Do. do.	Cum. Pref.	£1	7	22/-
British Aluminium	Ord.	£1	10	22/6
Do. do.	Cum. Pref.	£1	6	18/1½
British Celanese	Ord.	10/-	Nil	10/3
British Oxygen	Ord.	£1	8B	12/6
Do. do.	Cum. Pref.	£1	6½	18/1½
British Piston Ring	Ord.	£1	10	25/-
British Thomson-Houston	Cum. Pref.	£1	7	22/6
Brown Brothers	Ord.	£1	10	22/6
Do. do.	Cum. Pref.	£1	7½	21/3
Dick (W. B.)	Cum. Pref.	£10	5	112/6
De Havilland Aircraft	Ord.	£1	5	15/-
Dunlop Rubber	Ord.	C	6	13/7½
Do. do.	"C" Cum.Pref.	16/-	10	11/3
En-Tout-Cas (Syston)	Def. Ord.	1/-	Nil	1/-
Do. do.	Ptg. Pfd. Ord.	5/-	8	1/10½
Fairey Aviation	Ord.	10/-	10*	15/4½
Do. do.	1st Mt. Deb.	Stk.	8	106
Firth (T.) & John Brown	Cum. Pref.	£1	6D	8/6
Do. do.	Cum. Pref.	£1	3*D	8/-
Ford Motor (England)	Ord.	£1	10	31/3
Fox (Samuel)	Mt. Ptual. Deb.	Stk.	5	72½
Goodyear Tyre & Rubber	Deb.	Stk.	6½	97½
Handley Page	Ptg. Pref.	8/-	12½	10/9
Hoffmann Manufacturing	Ord.	£1	Nil	15/1½
Do. do.	Cum. Pref.	£1	7½	13/9
Imperial Airways	Ord.	£1	3	13/6
Kayser, Ellison	Ord.	£5	Nil	55/-
Do. do.	Cum. Pref.	£5	6	75/-
Lucas (Joseph)	Ord.	£1	20	58/9
Napier (D.), & Son	Ord.	5/-	15	4/3
Do. do.	Cum. Pref.	£1	7½	18/9
Do. do.	Pref.	£1	8	16/10½
National Flying Services	Ord.	2/-	Nil	-/4½
Petters	Ord.	£1	6	20/-
Do.	Cum. Pref.	£1	7½	18/9
Roe (A.V.) (Cont. by Armstrong-Siddeley Devel., *q.v.*)	Ord.	£1	—	—
Rolls-Royce	Ord.	£1	10	30/-
Smith (S.) & Sons (M.A.)	Def. Ord.	1/-	Nil	1/6
Do. do.	Ptg. Pfd. Ord.	£1	7	13/9
Do. do.	Cum. Pref.	£1	7½	15/-
Serck Radiators	Ord.	£1	15	30/6
"Shell" Transport & Trading	Ord.	£1	17½*	38/9
Do. do.	Cum. Pref.	£10	5	£9
Triplex Safety Glass	Ord.	£1	10	30/9
Vickers	Ord.	6/8	8	8/9
Do.	Cum. Pref.	£1	5*	16/6
Vickers Aviation (Cont. by Vickers, *q.v.*)	—	—	—	—
Westland Aircraft (Branch of Petters, *q.v.*)	—	—	—	—
Whitehall Electric Investmts.	Cum. Pref.	£1	7½	20/6

*Dividend paid tax free. B Rate per annum for nine months. C £1 unit of stock. D Last xd. on March 19, 1931.

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NEW COMPANIES REGISTERED

GEORGE DE LENGERKE AND CO., LTD., 629-630, Grand Buildings, Trafalgar Square, W.C.2.—Capital £100, in £1 shares. Objects, to acquire and hold shares, debentures, securities, etc., and to carry on business as managers of aerodromes, seaplane bases, motor services, etc. Directors: G. E. de Lengerke (director, Aircraft Investment Corporation, Ltd.) and C. B. L. Weiss, both of The Old Farm House, Motspur Park, New Malden, Surrey. Secretary, H. A. O'Neilly.

NATIONAL AVIATION DAY LIMITED.—Capital £1,000, in £1 shares Objects: to promote and encourage aerial navigation, and to organise and hold, or assist in organising and holding, aeroplane and other aircraft shows and exhibitions, etc. Sir Alan J. Cobham, K.B.E., A.F.C., is first and permanent director. Solicitors: Kenneth Brown Baker Baker, Essex House, Essex Street, W.C.2.

CLEWER AERO CLUB CO., LTD.—The nominal capital has been increased by the addition of £900 in £1 ordinary shares, beyond the registered capital of £100. The resolution to increase was passed in March, 1931, although duty was not paid until December. At the same meeting, the existing 1,000 shares of 2s. were converted into 100 of £1 each. It was also resolved that £100,000 of profit debentures—1,000 of £100 each—be created; half the distributable profits of each year to go to the profit debentures and half to the shares, provided that the profit debentures take priority for 6 per cent. per annum. In the event of such profits being insufficient, the 6 per cent. interest to be made good out of the general funds of the company.

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